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AUSTRALIA with Professional Electronics & ETI

Volume 59, No.11
November 1997

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Fax, scanner, printer...

Brother describes its MFC-1970MC as a 'multifunction centre', because it performs many of the functions needed in a small or home office. Barrie Smith has tested one out, and explains what he found on page 20.

Enhances viewing

Our new low cost Video Enhancer & Stabiliser project lets you tweak up the higher video frequencies when you're copying those precious family video recordings, for improved image quality. It can also remove teletext, vertical interval test signals and similar 'piggyback' signals, to give more stable viewing on older TV sets and monitors. See page 54...

On the cover

For the most impressive and realistic results with a home theatre system, you need a subwoofer to deliver the deep bass. But which subwoofer is best suited to your particular needs? This month Louis Challis has been testing six of the best units currently available — see his report, starting on page 10. (Photo by Greg McBean)

World of Electronics

Projects and Technical

Columns and Comments

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Professional Electronics

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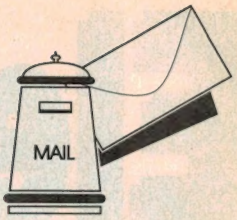
LETTERS TO THE EDITOR



DSS in Australia

I refer to the letter from Leigh Hauber published on page 4 of the September issue. Perhaps sometimes *EA* is too focussed on US developments, to the exclusion of what is happening elsewhere or right here.

As far as I am aware, Asiasat has been beaming digital satellite services into Australia for at least six months, if not longer. A number of European and Asian broadcasters offer broadcasting in at least a dozen languages. I was interested in a setup for Deutsche Welle TV, which reportedly broadcasts 24hrs in German. Apparently the daily program can be accessed on a web page, or you can fax them for a monthly program.

In Tasmania at least a 2.7m dish is required, and digital receivers from several manufacturers are available (Fuba and Wisi spring to mind). Jack Mekina of Mekina Technologies, PO Box 332, Hobart 7001 (ph 0417 570 991) is a local equipment supplier, and I'm sure there must be others.

On another note, digital broadcasting itself is quite advanced in Germany, with trials having run for about two years and full blown implementation commencing. Apart from being more spectrum efficient, digital appears to have substantial advantages for broadcasting to moving vehicles.

Peter Guenther, Senior Engineer
Andrew Boon Pty Ltd
North Hobart, Tas.

Audio shifter

I was very interested in Phil Allison's design in the August *EA*, as I have long had an amateur interest in sound reinforcement theory and practice. If someone offers the unit ready built and tested I could be tempted to buy one, but I lack the resources to do it myself with any confidence these days.

Phil says that the effect of the 5Hz frequency shift 'is at the threshold of perceptibility on speech', but I wonder if this is the case in all circumstances. Consider the situation which I meet regularly. We have a room which is comfortably full with about 100 people present. Anyone sitting in the front few rows is likely to receive about 50% sound direct from the person speaking and about 50% from the reinforcement system. I would have thought that these people would hear a pronounced vibrato from the 5Hz difference in frequency.

Is my guess right?

John Neate
Blackwood, SA.

We checked with Mr Allison, who confirms that a vibrato is indeed perceptible to people able to hear both the original and shifted signals. However in practice it rarely seems to be a problem.

Still reads us

Congratulations on 75 years of *Electronics Australia* and its predecessors. I must have been a reader for about 45 of those years! I still read it every month.

By the way, I particularly loved your comment in the third column of page 90 of the August issue: *(Editor: here is my guess — the Sun)*. Yes, I think you could be right!

Best regards,

Dick Smith
Terrey Hills, NSW.

Desoldering gun

Just a short note to let you know that the SECV control centre test group had a desoldering gun the same as the one described in the July 97 'Serviceman' column. We had a stand for our unit, which allowed it to stand vertically on the test bench. One day it exploded as described by Daniel Ford; fortunately no one was using it at the time.

This just goes to show that it was not a one-off event.

Ken Tate, Vic. (by e-mail)

Scope circuit

I've followed your Serviceman column with interest for a number of years, mainly out of an interest in 'who dun it' or more correctly 'what dun it', and have enjoyed it very much.

I now find myself in the possession of a Telequipment TD42 time based oscilloscope, in need of some TLC to get it back up and running to its original standard. It has not been used for a number of years and I suspect a number of the capacitors no longer perform their original duties. I have been unable to lay my

hands on anything approaching a circuit diagram, and I was wondering if you might know of a source that may help. The oscilloscope still works in a sense, and I can even get it to display a sine wave, but the timebase is way out, and I tried a square wave through it with interesting results.

Any information that anyone can give me will be most appreciated.

Keep up the good articles, for a very worthwhile magazine.

Andrew Niles, NZ (by e-mail)

Time warp?

EA doesn't seem to be the only electronics magazine in a time-warp that R.J. McCloy described in the July 97 issue. I noticed that another magazine described the System Requirements for Windows 95 in its May issue. By the way, the Zip drive review convinced my friend to go out and buy one, and he has never looked back. Now I'm saving up for one!

Ben Hood (by e-mail)

75th anniversary

Please accept most hearty congratulations for your 75th anniversary issue, from the members of the New Zealand Vintage Radio Society.

I think most members would agree with me in saying that the support your monthly magazine has given to vintage radio has been excellent (even if the regular 'Vintage Radio' column was written by one of our New Zealand members for a while!). Your magazine seems to have managed an even mix of the historical and super new aspects of radio and electronics, and your regular columnists have also held interest over the decades!

I feel the success of your 'readership' is closely aligned to the quality and wide variety of your electronics articles. There is still that magic of discovery in making something that seems almost too hard or too complex work, in often a simple yet elegant way.

The fact that your monthly magazine has continued to be produced for 75 years is an excellent achievement, and we wish you every continued success for the years to come.

Ian Sangster
President NZVRS,
Auckland, New Zealand. ❖

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT

DVD: another case of killing a goose before it lays golden eggs?

Despite all of the predictions that DVDs (digital video discs/digital versatile discs) were going to be the killer consumer electronics product of the next few years, I'm starting to get a strong and unpleasant whiff of *deja vu*. It's all starting to smell very much like other recent technical disasters, like PAL laserdiscs or DCC versus MiniDisc — or even Betamax vs VHS.

First there were the arguments about double-sided or dual-layer disc formats; then the battles over copy protection (still unresolved, with some major Hollywood studios refusing to release their movies on DVD); then movie producers forcing the establishment of distribution regions, with DVD players refusing to play the discs intended for other regions; then the continuing arguments about which digital surround sound format to use (Dolby Digital AC-3 or MPEG-2), ending in a crazy compromise to use them both, but in different regions; then the decision by firms like Sony and Philips to break away and develop their own formats; and now a move by the studios to develop a competing type of digital video disc which will be cheaper, but effectively only allow a single playing unless the user pays further 're-activate' fees...

It's all been an incredibly frustrating and off-putting saga, hasn't it? Frankly I wouldn't be at all surprised if there's a serious lack of enthusiasm among consumers, when the first production model DVD players and software finally *do* struggle onto the Australian market.

On a different subject, following the publication of our September issue we received a few critical comments regarding the reproduction of some of the colour photos. Which is not surprising, because some of them did turn out surprisingly dark — especially some of those that I had taken myself using one of the new Olympus C-800L digital cameras, on a trip to the USA. It was all very embarrassing, because as I said in my review of the camera, it actually captures very high quality images; not at all like the 'coal hole at midnight' reproductions that you saw in that issue!

What surprised us about that particular issue was the way the final printed result turned out so much darker than the proofs we'd had from the film makers. Needless to say we called for an urgent investigation (read 'witch hunt') to find out what had happened, and we've been assured that it shouldn't happen again.

You probably noticed that quite a few more of the images I took with the Olympus C-880L were reproduced in the article on Hewlett-Packard in last month's issue, and these did turn out rather better. (Phew!)

It's all part of our continuous learning process, as we cope with the many changes taking place in publishing technology. Just when we work out how to get good results reliably from one piece of hardware or software, it's replaced with another — and the whole process starts again!

Jim Rowe

WHAT'S NEW

IN THE EVER-CHANGING WORLD OF ELECTRONICS

Ultrathin laptops from HP & Mitsubishi

With the intention of expanding its product line with the thinnest, lightest notebook PCs ever, Hewlett-Packard has announced a collaborative relationship with Mitsubishi Electric. The relationship will enable the two companies to combine Mistubishi's superthin keyboard, battery and LCD display technology and manufacturing strengths with HP's notebook PC system expertise, distribution and support infrastructure.

To mark the announcement HP displayed a 'concept' product that weighs only 1.4kg, is less than 18mm thick and has a 12.1" viewable-image thin film transistor LCD display. The working prototype was demonstrated at Intel Corp.'s announcement of its new 200MHz and 233MHz Mobile Pentium processors with MMX Technology, and will include one of the new processors.

The first ultraportables from HP incorporating the new technology are expected to be available for North America and Europe during the first quarter of 1998. Mitsubishi will market the product in Japan.

Garmin marine chart plotter features GPS

The new Garmin GPSMAP 230 Chart Plotter incorporates the latest of Garmin's PhaseTrac12 parallel receiver technology, which tracks and uses up to 12 GPS satellites for fast and accurate positioning. It combines this with a large 18cm diagonal electroluminescent four-level gray display, and the latest G-Chart technology with seamless Navionics Charts, to provide a plotter which is claimed to suit the most serious off-shore user.

The GPSMAP 230 also has an extensive range of navigation features which include user-selectable data fields, simple point and shoot waypoint and route creation, fuel and trip planning as well as Garmin's exclusive TrackBack feature for automatic tracklog creation.

Other features include 250 waypoints, 20-route capacity of 30 waypoints each, 2000 track log points and a 'man overboard' feature.

The Garmin GPSMAP 230 comes with GME Electrophone's exclusive two-year warranty and is differential ready. It is supplied standard with remote antenna power data cable, user manual, surface/flush mounting bracket with knobs, and quick reference card.

Optional accessories include a full range of G-Map Cartography Cartridges.

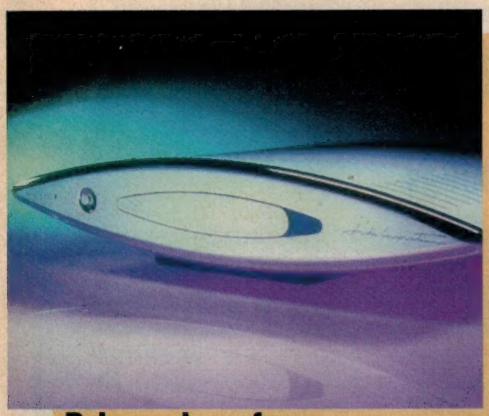
For more information circle 148 on the reader service card.

Surround speakers linked without wires

Philips has made it possible for consumers to set up a home entertainment system without running a mass of cables around the room. Its new flagship mini sound system (model FW 7SOWPRO) features 'wireless' subwoofer and surround channel speakers.

With conventional audio systems there's always the problem of ugly cables and where to hide them. But through the clever use of FM radio frequency, the new speakers are freed from the metres of cable usually required to connect them to the main audio unit. Without cables the speakers are easy to install and to place at major vantage points around the room for quality surround sound.

The FW 7SOWPRO has many other features, which are claimed to elevate it to state-of-the-art audio at an affordable price. These include Dolby Pro Logic sound, a three-disc CD changer and audio/video remote control. The system has an RRP of $1499 and is available from hifi and electrical retailers.



Prices drop for Audio Innovations

Grenfell Hifi, Australian distributor for the English specialist manufacturer Audio Innovations range of amplifiers, has announced a major price reduction for the whole range.

The ALTO series, which at this stage includes a CD player and an integrated amplifier, are now available for an RRP of $1149 and $999 respectively in black, or with chrome for an additional $150 each. These prices represent a reduction by as much as $300 per unit, largely thanks to improved exchange rates.

The Audio Innovations valve amplifier range has also been reduced. The L1 and L2 line preamplifiers are now $999 and $2299, the Series 800MKIII 25W class A power amplifiers are now $2899 and the Series 1000 50W Class A monoblock power amplifiers now $4999. A feature of all the valve designs is pure class A circuitry, with very short signal paths.

In addition to the price reductions, the warranty has been increased from 12 months to two years.

For further information circle 148 on the reader service card.

Pro-level digital camera from Sony

At the recent PC/IT Show in Melbourne Sony previewed an advanced digital studio camera designed specifically for the high-volume retail portrait market. Developed in response to user demand in the portrait market and in close cooperation with leaders in the US portrait industry, the Sony DKC-ST5 offers a high-performance digital image capture solution.

The DKC-ST5 offers photographic image quality coupled with a feature set designed for high-volume productivity. The camera has multiple frame memory, fast flash sync speed, instant photo proofing, and live video picture for use in image framing. It is claimed to provide outstanding image quality, low noise, superior colour reproduction, and virtually eliminates aliasing with the use of three diagonal spatial offset progressive-scan 1.4 megapixel CCD chips giving a resolution of 2560 x 2048 dots.

A feature of the DKC-ST5 is an overlay function, which provides a preview on the monitor of a composite image formed by combining that taken with the camera and a computer generated background image. The DKC-ST5 is also capable of continuous shooting up to nine images, which is especially useful for portrait applications.

The Sony DKC-ST5 will be available in Australia from December at around $40,000. For further information circle 140 on the reader service card or contact Sony Australia Limited.

Deluxe AM/FM stereo for boats

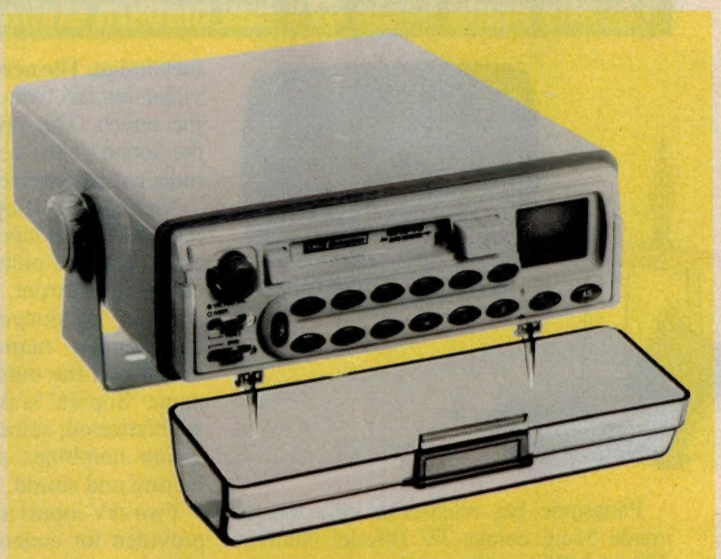
Sydney-based marine electronics firm GME Electrophone has released its new GR945 Deluxe Marine Stereo, successor to the company's very successful GR944. The new unit features a water resistant marine housing which enables the unit to be mounted and used in most open boat applications.

With an increase in output power to 25 watts per channel, and provision for connection to four speakers as well as an external amplifier option, the new GR945 is claimed to accommodate even the most critical of music listeners.

Other features of the unit include auto and manual tuning; extended station memory (18 FM stations, six AM); a large LCD panel which displays frequency, function and time clearly even in direct sunlight; bass and treble controls with loudness selector; and back lighting of display and controls for night operation.

Also available is a full range of waterproof speakers, external AM/FM aerials and a specially designed dash or bulkhead flush mounting kit.

For further information circle 145 on the reader service coupon.



Dye-sub colour printer from Olympus

Using the same powerful dye-sublimation technology featured in today's most sophisticated colour printers, the new Camedia P-150E printer from Olympus offers high speed printing of postcard sized (A6) images. The P-150E also delivers impressive 148dpi resolution and has a palette of more than 16.7 million colours, giving quality results at a very affordable price.

The printer comes with software drivers for Windows 3.1/95 and Macintosh, but also has a direct input which allows images to be printed directly from the Olympus C-800L or C-400L digital cameras, without need for a PC. An automatic feeder holds up to 25 sheets for continuous printing. The printer is compact in size and has a weight of only 3kg. It is supplied with an ink ribbon cartridge and 25 paper sheets.

P-50E replacement consumable packs are available containing a cartridge and 50 sheets.

Approximate retail prices are $899 for the P-150E printer and $85 for the P-50E consumable pack. For more information circle 147 on the reader service card.

New 'multimedia TV' from Philips

Philips is addressing the burgeoning multimedia marketplace with a new multimedia television (MMTV), a single receiver combining the functions of TV reception with VGA computer input. The company is marketing two stereo MMTV models, with 51cm and 68cm screens. Each MMTV has its own VGA (Video Graphics Adaptor) cable and stereo phono cable.

Philips says the MMTV models are retailing for only $200 to $300 above the prices of same-size conventional television sets, which is quite a saving compared to a brand new 51cm (20") monitor which retails between $5000 and $6000.

Anthony Toope, senior product manager for Philips Sound & Vision, said "One in three Australian homes — that's 2.5 million households — has a personal computer. That's an increase of 600,000 since 1994. Nearly four million Australians use a household computer."

"Our research shows there is a strong demand among PC users for something bigger and better than the little screens they have had to put up with on their computers," he said.

"MMTV provides an immediate high end alternative at a very affordable price. Hook up your notebook to a 68cm MMTV and suddenly you harness the power, the impact of big picture images supported by reverberating sound. This takes the computer out of the study and puts it up front in the most important room in the house — the lounge room, where the whole family can enjoy and benefit from it. Once you've had the MMTV experience there's no way you'll want to go back to a small screen."

RRP for the new 51cm MMTV is quoted as $1099. For more information circle 142 on the reader service card.

Locally made 51cm CTV has modern styling

Panasonic has released a new locally made 51cm colour TV (Model Number TC-51 M75A) with a unique modern cabinet design. The new model is a mono television but has twin speakers either side of the screen. This enables them to 'focus' the sound at the centre of the screen for more realistic sound reproduction.

Nicknamed 'Sophia' by Panasonic, the new model has a flat square and tinted screen and picture improvement circuitry for sharper, clearer pictures. The set is produced in Australia at Panasonic's manufacturing plant in Penrith on the outskirts of Sydney. The name 'Sophia' is derived from the word sophisticated, selected because this television combines sophisticated styling, picture and sound.

Two AV inputs and one AV output are provided for connection to other audio-visual equipment. A control lock feature allows the user to set the volume to the maximum desired setting and activate a software lock so this maximum cannot be exceeded. The colour, brightness and contrast will also remain at set levels.

The TC-51 M75A also has automatic search to make tuning easy, on-screen display, NTSC playback and a 30/60/90 minute off-timer which allows you to set the television to turn off automatically.

As with all Panasonic's Australian-produced televisions, the set conforms to the Australian Standard AS3250 for electrical safety and AS1053 for electromagnetic compatability (EMC). It is available from leading electrical retailers for an RRP of $799.

For further information circle 149 on the reader service card.

New Duntech 'Opal' speakers

Australian loudspeaker system maker Duntech has released its new Opal system, one of the first of a new line-up called the Gemstone range. The company says the Opal has been carefully designed to provide the most accurate sound at a more affordable price.

The Opal is claimed to incorporate the same design principles used in the company's Sovereign system, claimed as 'the world's most accurate loudspeaker'. It is a two way, three driver design in which the drivers are arranged in a symmetrical fashion along a vertical axis. The drivers are also 'time collimated' (aligned) to ensure that the overall sound is clean and well defined.

Acoustic absorbing material around the tweeter avoids any unwanted reflections of the sound from the front of the loudspeaker. For tightly controlled but extended bass, Duntech have loaded the upper driver by means of a sealed enclosure while the lower driver is loaded by means of a precision tuned dual reflex design.

The two 165mm bass driver units feature a unique vented double magnet system, damped polymer composite cone and rubber surrounds that meet Duntech's tight specification. The unusually large voice coils of the drivers use a special hexagonal cross-section aluminium wire with excellent heat conductivity properties. The tweeter is a 25mm 'hand treated' soft dome type.

The enclosures are constructed from 18mm thick MDF, chosen for its special damping qualities and then finished in the finest hand rubbed Australian Jarrah or Queensland Walnut veneer. The cabinets are computer optimised, internally braced and rigidly constructed to control unwanted cabinet resonances.

Designed for amplifiers from 30W (4Ω) upwards, the Duntech Opals produce the best results in small to medium sized rooms. Covered by a five-year parts and labour warranty, they are available at selected dealers throughout Australia. For more information circle 141 on the reader service coupon.

Lower cost CD recorder from Pioneer

Pioneer's new PDR-04 CD Player/Recorder follows in the footsteps of the company's successful PDR-05 model released last year, now offering what is claimed as the same high quality sound and superior recording ability for under $2000.

The main feature of the PDR-04 is its ability to record onto a recordable compact disc (CD-R). Pioneer have taken all possible steps to ensure that the recording process is easily done and that the result is of a standard expected of studio-recorded discs.

When recording from CD, DAT, MD or other digital source, the PDR-04 simplifies the recording process through its Auto Digital Source Synchro Recording. The recorder automatically starts and stops in synchronisation with the start and playback of the source component.

A key contributor to the PDR-04's audio performance is said to be a new single-bit D/A converter, which features an eight-times over sampling digital filter, DAC and analog filter all integrated into a single IC. The transport also features a 'stable platter mechanism', where the disc is recorded and played 'music side up' on a sturdy platter which provides smoother drive.

Other features of the PDR-04 include auto record/pause, record mute, TOC Write ('Finalise'), sampling monitor, fade-in/fade-out and auto/manual track increment. The unit incorporates SCMS (Serial Copy Management System), which allows direct digital CD-R recording of CD or DAT audio sources, but does not allow such recordings to be used as a source for digital re-recording.

The PDR-04 CD recorder has an RRP of $1999 and is covered by a two year warranty (12 months laser). For further information, circle 144 on the reader service card.

Home theatre packages from Panasonic/Technics

Panasonic has released a range of home theatre packages which it says combine Panasonic and Technics products to make home theatre uncomplicated to purchase, install and operate. By combining a Panasonic television, a Hi-Fi VCR and a Technics Dolby Pro Logic mini system or individual components including speakers, customers are able to buy packages ranging in RRP from $3000 to $12,000.

The packages include conventional televisions ranging in size from 51cm to 78cm and wide screen TVs of either 66cm or 76cm, right up to the 119cm TX47WG25H wide screen video projection TV. These are coupled with the NVHD620A or NV-HD650MK2A Hi-Fi VCRs and a mini hifi system or separate hifi components. A part of some packages is the new Technics SC-EH60 Dolby Pro Logic mini system, which offers 70W per channel, a five-CD changer, a double cassette deck, an FM/AM stereo synthesiser tuner and a 15-band spectrum analyser.

To house the products, Panasonic has produced several purpose-built stands which are designed to suit a range of decors. There are three different stand designs which are available in black or cherry oak. The various designs fit either the mini system or the full-size components.

Panasonic has also produced a Home Theatre catalog which details each of the recommended packages. For further information circle 146 on the reader service coupon. ❖

ACTIVE SUBWOOFERS: TESTING SIX OF THE BEST

This month, our reviewer Louis Challis turned his instruments and calibrated ears on a selection of six current-model active subwoofer systems, of the type now popular for extending the bass response of surround-sound systems and home theatre systems. If you're thinking of adding a subwoofer to your system, his results should really help in picking the right one for your needs...

If you were to examine the type and proportion of loudspeakers now sold nationally and internationally, then the largest proportion would probably be categorised as 'bookshelf' speakers. As attractive as these compact loudspeakers may be, with few exceptions they tend to 'lack something'. That something is extended low frequency response, which my children describe as the 'whoomp, whoomp' — an integral part of some of the more popular pre-recorded music (and audio-visual material) that we frequently play for our enjoyment.

Thirty years ago, the best loudspeaker enclosures were physically large. Their significant volume, when coupled to a good speaker driver, ensured an extended low frequency response. Of course developments in speaker technology, and most particularly the judicious application of Thiele/Small parameters, have resulted in smaller and more effective speaker enclosures which often also achieve an extended low frequency response.

At the same time there has been a trend towards even smaller loudspeakers, accelerated by the proportion of the population who have moved into city apartments, where space is at a premium. Alas, this further size reduction is invariably achieved at a functional cost — namely, a general loss of the original low frequency spectral energy, particularly in the frequency region below 80-100Hz.

Do we really need to hear the low frequency components below 80-100Hz? The answer is that if the original recorded material contained significant content at the bottom end of the audible spectrum, and if you believe that you're missing out on something important by its absence, then clearly you have a problem that needs to be resolved. Basically if you are listening to a disc on which the musicians play drums, a double bass, a pipe organ or even an electronic moog synthesiser, and you find that you can't really hear those instruments except as a muted sound, then it is more than likely that you will be distressed at the quality of the sound reproduction.

Of course this situation has existed for quite a while, and has generally been ignored by most of the population, who have been reasonably happy with their

truncated sound. And things would probably have continued that way, had it not been for parallel developments in the visual entertainment field.

The development by Lucasfilms of their THX system, and Dolby's development of Dolby Digital (AC3) has changed the rules for both commercial and consumer electronics. Those systems adopted multiple sound channels (front, centre and rear), supplemented by a dedicated low frequency sound channel for maximum acoustical impact. THX and Dolby Digital were immediately accepted in the cinemas, and rapidly changed the consumer home cinema market as well. As a result, many more people have become aware of the benefits of using a subwoofer to restore the 'missing' sound at the low end of the audio spectrum.

While the earliest subwoofers tended to need separate amplifiers, subsequent developments focused on integral amplifiers and matching crossover filter networks. These have assured a simplified method of interconnection and integration with an existing sound system, as well as what I would describe as 'other user friendly features'. Of these the most significant was the incorporation of circuitry which detects whether the subwoofer has any significant input signals, and automatically de-activates its amplifier circuitry after a period of inactivity, thereby saving you one extra chore.

Two broad types

It appears that there are now two different classifications of subwoofers being marketed. The first type has been designed to provide a relatively smooth, or broadband frequency response over the range from 30Hz or 40Hz through to 100Hz. When coupled to your existing loudspeaker system, this provides the mechanism through which you can achieve a smooth frequency response covering the range from 30-40Hz all the way through to 16kHz or 20kHz.

The second type appears to have been designed to satisfy the specific needs of home theatre reproduction. The functional requirements of this type is to replicate (but not necessarily faithfully reproduce) the bursts of low frequency sound energy generated during explosions, and other audible transient events, where the 'impact effect' is more important than the faithful reproduction of the original audible content.

Although each of those classifications of subwoofers may have been developed with a different aim in view, the manner in which they were used, and ultimately the sounds that they reproduce, are sufficiently similar in character to evoke a comparable physiological response.

At present there are at least 30 or more different brands or models of subwoofer available in Australia and New Zealand, and inevitably all of them are based on five basic configurations commonly used to construct this type of systems. Those five systems are shown schematically in Fig.1.

The first, and most common system (Configuration 1), is the conventional bass reflex enclosure. Here the low frequency resonance is determined by the length and diameter of the resonant loading port, and the associated cabinet volume. The aerodynamic characteristics of the loading port are important because if the inner and outer ends are not flared, turbulent high frequency noise will be created at high drive levels.

The reflex enclosure's principle of operation makes use of the augmented acoustic wave that propagates with a reversed phase through the reflex port. When appropriately configured, the output response is increased by 3dB over a range of frequencies. Below the operable range, the sound produced by a reflex enclosure experiences a sharp roll-off, which is much sharper than that produced by the next most popular classification.

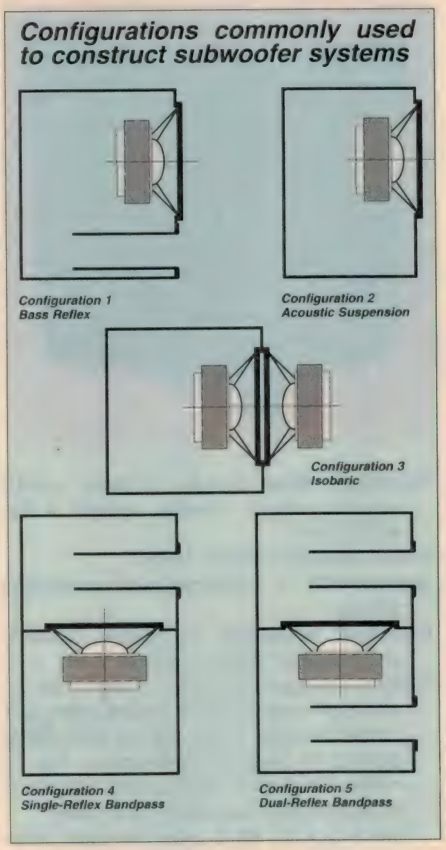


Fig.1: The five basic configurations used in subwoofer speaker systems, as discussed in the text.

The second most popular system (Conf.2) is the simple acoustic suspension, which requires a fairly compliant loudspeaker and an appropriately sized cabinet volume. The major advantage of the acoustic suspension system is that it has a smooth roll-off below the resonant frequency, thereby achieving a substantially broadened and thus a generally enhanced low frequency response.

The third configuration (Conf.3) is commonly known as the *isobaric* enclosure, which is sometimes described as the constant-pressure design. The underlying design principle is based on wiring two drivers in parallel, with the cones facing each other. As the cone of the internal or rear woofer pressurises the volume of air enclosed within the cabinet, the front woofer is then free to respond as if it were installed in a box with a somewhat larger volume. The nett result is to achieve a lower cut-off frequency for a given cabinet volume.

The major liability of the isobaric subwoofer enclosure is the need to provide two relatively expensive drivers, as well as a power amplifier with effectively twice the power rating that you would need for one driver.

The fourth configuration (Conf.4) is the single reflex bandpass enclosure, in which a loudspeaker is acoustically suspended in front of an inner enclosed section of the cabinet. That sub-enclosure encompasses a carefully selected volume of air. The loudspeaker then faces a separate vented reflex cabinet on its outermost side. The ported cabinet provides a sharp cut-off at the upper end of its operating spectrum. The nett result is a substantially improved low frequency performance — but only when the reflex port is configured with both smooth entries and exits.

The fifth configuration (Conf.5) is the dual-reflex bandpass system, using either a single driver or a pair of drivers installed on a central baffle. One side of the cabinet is provided with a reflex port with its coupled cabinet volume tuned to a relatively low frequency (40-50Hz), while the other side is another reflex system tuned to a higher frequency, typically 70-80Hz.

An advantage of the dual-reflex bandpass subwoofer is that it can achieve a relatively smooth response which may be broadened out. If one attempts to make the response too broad, then the gentle valley between the two peaks may become too pronounced, and the smooth response may be degraded.

Another major advantage of the dual-reflex bandpass system is that within the normal operating range, the amount of power required and the extent of cone/diaphragm excursion is dramatically reduced. In simple terms that means you can use a smaller driver (or a pair of smaller drivers) to achieve prodigious outputs, with relatively low input powers from the amplifier provided for that purpose.

The systems tested

The purpose of this review is to evaluate the attributes and other features of the most common of the above design configurations. The aim is to present you with a direct means to assess the differences in test data which we have recorded.

The six subwoofers which we received for testing were as follows:

JBL	Model Sub-10
N.E.A.R.	Model PS-2
Solid	Model PB100
Sony	Model SA-W301
VAF	Model DC-S
Yamaha	Model YST-SW300

We'll now look at each of these systems in turn.

JBL Sub-10

Technical data: Height 450mm, width 610mm, depth 342mm, weight 22kg. RRP $699

Power amplifier: 100W RMS

Woofer size: 250mm (external protection grid)

Crossover frequency: 90-200Hz, continuously variable control on front panel

Features: Large volume control on front panel; phase reversal switch and bezel light which changes from red to green when the circuitry is active.

The JBL Sub-10 is an impressive subwoofer which uses a conventional bass reflex design. In keeping with all of the other models tested, it provides the option of low level coaxial line inputs, using a pair of RCA sockets, supplemented by two pairs of high level spring-loaded terminals to allow the subwoofer to be connected alternatively into the leads from the output from your main amplifier to the existing speakers, to get its input signals that way. This allows the subwoofer to be used with amplifiers which lack designated subwoofer output(s).

The Sub-10 cabinet's four sides and rear are solidly made from MDF board. The front panel is attractively moulded from a filled plastic, on which the amplifier's heatsink and the 300mm driver are both mounted. A neatly flared venting port is incorporated into the lower edge of the front panel, so that it will sit close to the floor.

The Sub-10's venting port is different from all of the others, in that it incorporates a rectangular low resistance protection grid near the inner end of the reflex port to inhibit the entry of unwanted objects, or small animals which may take a liking to the frequently quiet and normally dark space inside the cabinet.

The front, sides and rear of the cabinet are neatly finished in black lacquer, and thus the system has a rather sombre appearance. Automatic circuit de-activation has been incorporated, which switches off the main power supply following a period in which no input signal is detected.

The Sub-10 is the largest of the six subwoofers tested. In a moment of levity, the importers describe it as having 'bar fridge' dimensions. This seems a rather apt description for what proved to be an excellent subwoofer.

The N.E.A.R. PS-2

Technical data: Height 510mm, width 454mm, depth 356mm, weight 41kg. RRP $2999

Power amplifier: 200W RMS

Woofer size: 2 x 200mm (with removable grilles)

Crossover frequency: 50-180Hz, continuously variable control on front panel

Features: Heatsink mounted at rear of cabinet, with three coaxial inputs for left, right, and centre channels. Three sides of the cabinet finished in black painted veneer. Top of cabinet finished in high quality contoured multiple coated lacquered MDF panel.

The N.E.A.R. PS-2 was the only subwoofer of the six which did not provide high level connections for making the typical connections to your existing amplifier's speaker terminals, and through which you would connect your existing loudspeakers. The PS-2 has been designed to connect into a conventional THX receiver, or directly to a DVD player (Dolby Digital or MPEG 2 subwoofer terminal), each of which provides a suitable low level decoded signal for a self-powered subwoofer.

The design of the PS-2 adopts a variation on the conventional acoustic suspension system concept. It uses two speakers instead of the more common single speaker, thereby achieving a remarkably good low frequency performance, with a double hump in its response. The amplifier employs a thermally effective toroidal transformer adjacent to the printed circuit board. The cabinet is very solidly constructed with supplementary internal stiffening elements, which retain a thick layer of bonded polyester damping media. The top of the cabinet is beautifully finished with a thick and extremely smooth lacquered decorative panel.

Solid Solutions PB100

Technical data: Height 415mm, width 353mm, Depth 401mm, weight 12kg. RRP $499

Power amplifier: 70W RMS

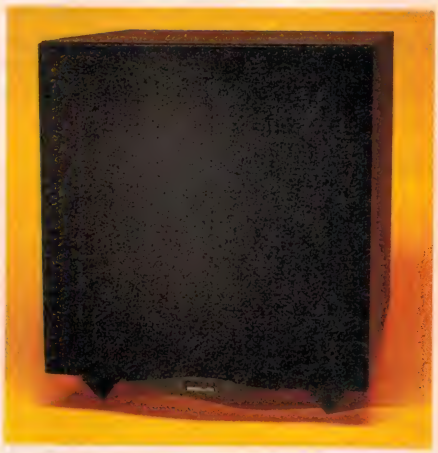
Woofer size: 250mm

Crossover frequency: Fixed (no variable high pass or low pass controls provided)

Features: Phase reversal switch, high and low level line input and line out terminals. The cabinet and its detachable grille are neatly moulded from matt black plastic. The cabinet is small and attractive , with an excellent aerodynamically shaped loading port moulded into its base.

The PB100 incorporates an unusual, but very practical and most effective flow port design in the base of the cabinet. The cabinet sits on four inverted conical spike-like mounting feet. These provide minimum aerodynamic 'drag', and in conjunction with the smooth port, ensures the lowest possible level of regenerated aerodynamic noise.

The subwoofer is tuned to a 70Hz peak.



As tested under anechoic conditions (above a fully absorptive floor), the low frequency response is marginally different to that which would be provided with the subwoofer placed on a conventional floor (timber or carpeted).

Sony SA-W301

Technical data: Height 580mm, width 205mm, depth 400mm, weight 16kg. RRP $809

Power amplifier: 75W RMS

Woofer size: 160mm

Crossover frequency: 50-120Hz, continuously variable control on front panel

Features: Remote control, with volume and muting functions. Phase switch, low frequency boost switch, line level audio connecting cords plus two speaker cords.

The SA-W301 subwoofer is one of the most attractive of the six, as it has been designed to fit into a narrow gap between or behind furniture, as appropriate. The SA-W301 provides two low level line input connections on the rear of the cabinet

near its base, with four pairs of spring-loaded terminals for amplifier output and associated loudspeaker connections. The cabinet is constructed from 16mm MDF board with a high quality black lacquer finish. The top section of the front panel uses a high density moulded plastic escutcheon, above a large contoured cloth covered speaker grille. This hides the well configured loading port, and an internal single-reflex bandpass speaker enclosure which is located at the bottom of the cabinet.

Although the SA-W301 has a volume control, the remote control provides a much more convenient means of adjusting the subwoofer's sensitivity. This is supplemented by the muting switch, which will frequently offer a functional advantage that none of the other units provided.

The VAF DC-S

Technical data: Height 430mm, width 430mm, depth 430mm, weight 30kg. RRP $999

Power amplifier: 180W RMS

Woofer size: 2 x 210mm

Crossover frequency: Adjustable from 40Hz to 180Hz.

Features: Low level line input and line output sockets, universal terminals for high level amplifier and external speaker connections, IEC mains power socket with integral accessible fuses. Phase switch, auto and manual ON/OFF power switch, level control, and very thick internally braced MDF construction.

The Australian made VAF DC-S subwoofer, although not the largest of the six tested, is clearly the second heaviest and is very solidly constructed. It has adopted a dual-reflex bandpass design, to achieve a broad and effective low frequency response which extends from approximately 30Hz to 120Hz. The two loading ports are located on the rear panel. When placed on the floor, all that is visible is a black box.

The adoption of equal diameters for the two loading ports results in a marginally lower output from the low frequency portion of the system when compared to the high frequency section. VAF currently offers a most attractive $28 inclusive fee for delivery and insurance to any location in Australia.

Yamaha's YST-SW300

Technical data: Height 500mm, width 400mm, depth 434mm, weight 26kg. RRP $999

Power amplifier: 185W RMS

Woofer size: 300mm

Crossover frequency: 40-140Hz, continuously variable control

Features: Music or movie switch position to provide a low frequency response which is relatively flat over the range 28Hz to 100Hz for movies, or a drooping low frequency response for music. The high pass filter output has switch-selectable settings of 50Hz, 80Hz and 100Hz. The enclosure is solidly constructed from MDF with major controls recessed on one side.

The YST-SW300 is the latest of Yamaha's Active Servo Technology systems. It incorporates a number of attractive features, including the adoption of universal speaker terminals which accept banana plugs (this was the only one of the six to do so). The YST-SW300 also provides a switch-selectable line output high pass filter circuit supplementing the phase reversal switch, and an auto power ON/OFF function.

The cabinet is very solidly constructed from 20mm MDF board, and the electronic circuitry uses discrete components which ensures maintainability and ease of repair at reasonable cost, should an electronic malfunction occur.

Testing & evaluation

Testing and evaluation of the six subwoofers was relatively straightforward, and adopted the following principles and procedures to extract the information listed:

The first stage of the evaluation involved a measurement of each subwoofer's frequency response at a distance of 1m in my anechoic chamber. Where multiple or variable high frequency cut-off controls were provided, these were also evaluated at a mid-range or 50% position, and at the extreme counter-clockwise position (100%). Where additional bass boost circuitry was provided, this was also evaluated.

Whilst installed in the anechoic chamber, the distortion parameters were measured at three relevant frequencies: 25Hz, 50Hz and 75Hz. The output levels adopted for this test were respectively 90dB at 25Hz, and 100dB at 50Hz and 75Hz. As all of the subwoofers provided a significant or peaking output in the vicinity of 75Hz, the maximum output level for 10% distortion at 1m was also measured.

The last but by no means least important test was to evaluate the audible performance of the subwoofers with some representative test software.

In evaluating any subwoofer, the primary intended usage should ideally be known in advance. Some subwoofers are specifically designed for music, and typically display a drooping low frequency response.

Subwoofers that are specifically intended for video or home theatre sound enhancement should ideally have an extended low frequency response, and a useful, and preferably a reasonably high sound pressure output in the critical 20-40Hz region. As you will note, only some of the subwoofers displayed this performance.

To provide a realistic assessment of each subwoofer's performance, I used a pair of Quad electrostatic speakers whose primary effective frequency range extends from 100Hz to 20kHz. With the exception the N.E.A.R. PS-2 subwoofer, the Quads were connected to the high level outputs of each of the subwoofers tested. With the N.E.A.R. PS-2 I used the second set of line-output terminals on my Yamaha preamplifier, which resolved what might otherwise have proven to be an embarrassing problem.

For each separate evaluation I initially used a band of pink noise to optimally adjust the level of the subwoofer, and to confirm that the spectral balance was smooth with no audible rumbling or gross discontinuity. I sequentially evaluated the combinations of the two Quads and each subwoofer with three new discs. Each of the test discs was selected on the basis of the quality of its sound, with specific tracks selected which incorporated appropriate low frequency content.

The first disc was Bobby McFerrin's 'Circlesongs' (Sony Classical SC 62734), which features eight madrigals and a choir of 13 male and female singers as a back-

ing. The difference in perceived sound quality and the intimacy of the music on this disc is enhanced to an unprecedented degree by an effective and appropriately adjusted subwoofer.

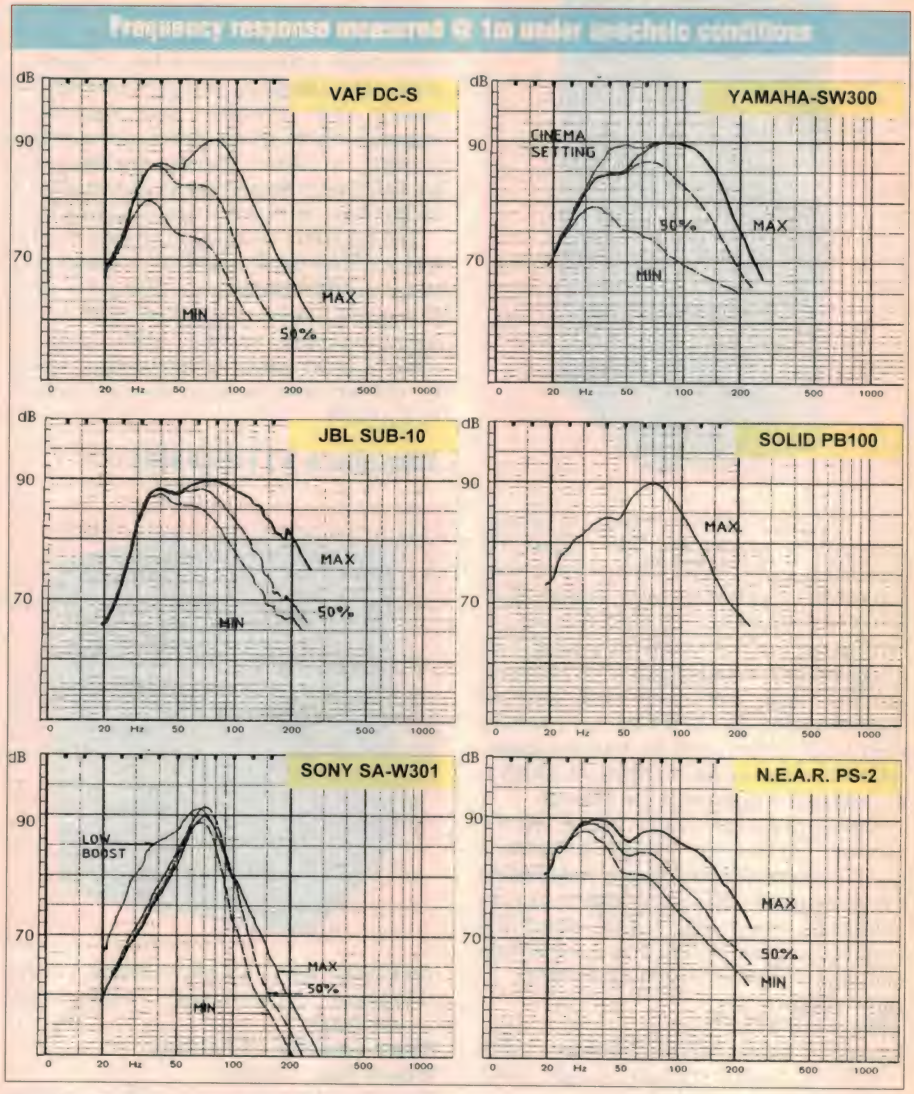
The second disc was Franz Lehar's Operetta *Giuditta*, sung in English with Richard Bonynge conducting the English Chamber Orchestra (Telarc CD-80436). At the start of tracks 2 and 12, in scenes 1 and 3, there are some outstanding (natural) drum rolls which exemplify the difference in sound quality between a home sound reproduction system that either 'has what it takes' or lacks what is needed to faithfully replicate the original sound in all its quality.

The third disc I used was 'Illumination' with Hildegard von Bingen's The Fire of the Spirit, tracks 1 to 3 (Sony SK62853). The first three tracks provide some magnificent and compelling music, whose composition and brilliant backing are a perfect vehicle for evaluating the audible enhanced performance afforded by an add-on subwoofer system.

Overall, these discs demonstrated the degree of enhancement that subwoofers can play in a music reproduction system and particularly when, or if your loudspeakers don't provide useful output below 80Hz. A-B comparisons reveal components in the original music which are completely lost unless you add in the low frequency boost, which only a subwoofer can provide.

Each of the six subwoofers I evaluated provides a worthwhile sound quality enhancement. I only regretted that I did not have a DVD or a laserdisc with Dolby Digital (AC3) output and one of the many 'megafilm' type soundtracks to provide an appropriate vehicle for comparative evaluation. In the end it didn't really matter, though. I discovered that each of the subwoofers has the ability to fulfil either a part or all of that requirement, when correctly adjusted in an appropriate sized listening room with a reasonable set of stereo loudspeakers.

Table 1 summarises the most important performance characteristics of the six subwoofers. The final column presents my assessment of their performance characteristics, which is independent of their price.



The frequency response for each of the six subwoofer systems, as measured in Louis Challis' anechoic chamber.

Of course we all live in a real world where cost considerations often tend to outrank most other parameters. When you add the cost of the subwoofer into your evaluation equation, then the best 'dollars per decibel' performance appears to have been won by the JBL Sub-10 and the Yamaha YST-SW300.

When size and visual impact are important, then the Solid PB100 and the Sony SA-W301 have a clear advantage in terms of size for performance. And when price, weight and bulk are not the primary assessment parameters, then the VAF DC-S and N.E.A.R. PS-2 are the two outstanding performers. ❖

1997 SUBWOOFER TESTS: Comparative Data

Brand & Model	Peak Output SPL for 75Hz @ 1m	Distortion at 25Hz, 90dB	Distortion at 50Hz, 100dB	Distortion at 75Hz, 100dB	Frequency Response - 6dB	Broadband or Peaking response	RRP	Overall performance
JBL Sub-10	117dB	40%	2.5%	0.5%	30 - 140Hz	Broadband	$799	Excellent
N.E.A.R. PS-2	108dB	16%	18%	1.2%	22 - 130Hz	Broadband	$2999	Excellent
Solid PB100	110dB	14%	7%	0.8%	(40 - 100Hz)	Peaking	$499	Very Good
Sony SA-W301	109dB	75%	1.4%	0.6%	50 - 90Hz	Peaking	$899	Good
VAF DC-S	114dB	2%	1.8%	1.7%	32 - 105Hz	Broadband	$999	Excellent
Yamaha YST-SW300	110dB	9%	3%	1.8%	25 - 130Hz	Broadband	$999	Excellent

MicroGram Computers

Omni-Directional Laser Scanner

An affordable, vertically mounted, Omni-Directional laser scanner, which is ideally suited to reading bar coded products at supermarket checkouts. Performance is higher than the "Name Brands" with a 24 scan line pattern (competitors' products are 20) and 2,400 scans/sec (competitors': 2000 scans/sec). The depth of field is 300mm and it has a keyboard wedge interface. A serial interface is also available.

Cat. No. 8521 **Bar Code Laser Omni-Direct. Scanner** $1999

Bar Code / Label Thermal Printer

A flexible barcode printer which provides thermal transfer or direct thermal printing. Print speed is selectable from 1, 1.5 or 2" per second with a resolution of 203 dpi (8 dots per mm). Print width is 4" & print length 6" with 128 KB memory (256K optional).

Cat. No. 5418 **Bar Code / Label Thermal Printer** $1499

Bar Code Slot Reader

An alternative to magnetic card readers - no expensive card writer is required! Ideal for club membership cards, etc. A bar code is affixed to the card and the card swiped through the reader. It can be configured as a keyboard wedge or for serial connection.

Cat. No. 8044 **Bar Code Slot Reader - KB Wedge / Serial** $499

Printer Extender

A simple solution for operating your printer at up to 400 metres from your computer. It includes a 10 m 4-wire telephone cable to connect the sending and receiving modules & will transfer data at up to 21 KB/sec.

Cat. No. 12020 **Printer Extender - Non Powered** $59

Two Port USB Card PCI

Provides 2 USB ports with a bandwidth up to 12Mb/s. Supports real time dynamic insertion and removal of up to 127 devices.

Cat. No. 2622 **Two Port USB Card PCI** $69
Cat. No. 9093 **Universal Serial Bus Cable** $12.95

Ultra High Speed Serial Card

Break the barrier with this two port card featuring 16650 UART chips with 32 byte FIFO buffers. It provides interrupts 3, 4, 5, 7, 9, 10, 11, 12 & 15 as well as being configurable as COM 1,2, 3, 4, 5, 6, 7 or 8.

Cat. No. 2333 **Two Port 16650 Serial Card** $149
Cat. No. 2239 **Two Port 16550 Serial Card** $99

Modem Sharer

Share a single modem or plotter, etc with mutiple computers. Modem Share is a powerful, easy-to-use adapter for serial data communication between PC's and one shared modem. Based on the principle "first come first served", it operates up to 128 kbps over a distance of 460 metres.

Cat. No. 11804 **Modem /R232 Sharer - Computer End** $99
Cat. No. 11805 **Modem /R232 Sharer - Printer End** $99

Printer Sharers

Simply share 4 printers between up to 40 PC's. Transmits data up to 460m at 10,000 char/sec over 6 wire telephone cable. A small 4-way switch allows the desired printer to be selected. There is no software so they happily work under DOS and Windows.

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Cat. No. 12030 **Printer Share - Printer End** $99

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Available in either 1, 2 or 3 port versions, these bi-directional parallel ports have an 83 byte FIFO buffer that can be configured to LPT1 (3BC), LPT2 (378), LPT3 (278), LPT4 (268), LPT5 (27C) or LPT6 (26C) and set on interrupts 3 to 15.

Cat. No. 2314 **1 Port** $40
Cat. No. 2315 **2 Port** $59
Cat. No. 2316 **3 Port** $97

ECP/EPP Parallel Port Cards

Add ECP/EPP speed to your system with data transfer rates up to 1Mb/sec. Both ports provide 7 selectable I/O port addresses and 10 selectable IRQ's as well as two selectable DMA channels.

Cat. No. 2235 **1 Port** $79
Cat. No. 2236 **2 Port** $94

Surge Suppressors

Protect your equipment & networks against power fluctuations, spikes, cross talk, induced transients & close proximity lightning strikes.

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Cat. No. 8387 **RS422 DB15** $59

Complete 10BaseT protection. Surge protection prevents connections being lost on the network.

Cat. No. 8388 **10BaseT RJ45 1 Port** $59
Cat. No. 8389 **10BaseT RJ45 4 Port** $120
Cat. No. 8390 **10BaseT RJ45 8 Port** $245
Cat. No. 8391 **10BaseT RJ45 12 Port** $335
Cat. No. 8392 **10BaseT BNC 1 Port** $59

Ethernet 5 Port UTP Hub

A compact 5 port 10Base-T hub that delivers a straight forward solution for expanding an additional node. As long as there is an existing 10Base-T drop, you can easily expand to add one to four nodes without extra wiring costs. It supports all the features of a full-sized, standard 10Base-T hub, including automatic port partition, jabber function, polarity detection & correction, uplink port, and extensive diagnostic LED's.

Cat. No. 11278 **Ethernet 5 Port UTP Hub** $99
Cat. No.11287 **Ethernet 5 Port UTP Hub Card** $89

Compact Keyboard

When desk space is at a premium an 80 key keyboard with full 101 key functionality will come in handy. It has dimensions of only 297(W) x 152(L) x 30(D) mm.

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PCI Network Cards

These 32-bit PCI cards are available with either standard architecture or high performance Bus Master architecture providing priority control. Both cards are PnP with IRQ's & I/O address assigned by PCI BIOS.

Cat. No. 11266 **Ethernet PCI Bus Master** $95
Cat. No. 11271 **Ethernet PCI** $69

Also available, ISA full duplex PnP Ethernet cards.

Cat. No. 11276 **Ethernet 8/16 Bit BNC/UTP PnP** $45
Cat. No. 11272 **Ethernet 8/16 Bit BNC/UTP PnP Jmp** $59

VGA Monitor Splitters

These splitter modules enable up to 8 monitors to simultaneousy share the information of a host computer. The ideal way of providing multiple displays in training rooms, airport terminals, stock rooms, clubs, etc. The splitter may be up to 15m from the computer while the monitor may be up to 100m from the splitter for the 2 way module and up to 50m for the 4 and 8 way modules.

Cat. No. 3070 **Two Output** $239
Cat. No. 3055 **Four Output** $336
Cat. No. 3056 **Eight Output** $574

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READER INFO NO.2

WEBTV: IT COULD COME TO A TV SET NEAR YOU!

No doubt there are a lot of people who would like to explore the internet, but until now have been put off by the need to have a personal computer and modem, etc. In the USA a lower cost and easier to drive alternative approach using a set-top box and a normal TV receiver is being offered by WebTV, and it seems to have a lot of appeal. Here's what Tom Moffat found when he tried one out.

by TOM MOFFAT

"In the very near future, the computer industry as we now know it will be... DESTROYED. A new technology will have such global impact that it will... completely change our lives. The Information Highway has been repaved..." So goes the hype announcing the birth of WebTV. There's a big glossy brochure, in startling red and black: 'The POWER of the INTERNET now showing ON YOUR TV! WebTV network — it's EVERYTHING you're into and NOW there's nothing to it! WELCOME TO THE FUTURE'.

That sets the tone of the WebTV scene: big, powerful (Bill Gates now owns it) and hard sell. But WebTV represents some interesting technology too — a whole new system of Internet access that eliminates the need for a computer (or more accurately, it hides the computer from the user). And WebTV is about to hit the big time in the USA, with Australia likely to follow soon.

Let's consider the traditional Internet setup. First you have your computer, probably an IBM-PC of some kind, running Windows 3.1 or Windows 95. Or, it could be a Macintosh. On top of the computer is a big colour monitor, or (as in my case) a colour screen in the lid of a notebook computer.

Somewhere in the computer or connected to it is a modem, which connects to a telephone line. There is some software which can make a phone call through the modem and set up an Internet connection. And finally there is more software, usually a World Wide Web browser, that can make use of the telephone connection to cruise around the Internet.

At the other end of the phone connection is an Internet Service Provider, or ISP, which performs several functions. Primarily, the ISP figures out who you are, starts the clock running for billing purposes, and then turns you loose on the Internet. The shortest route is in through a modem and out through a thing called a router, straight into cyberspace.

The ISP also has its own World Wide Web server, for the use of its members and the general public. This server usually provides your 'home page', although if you want to be different you can call *anything* your home page, such as the White House or the Prime Minister's Department. Technically, it matters not.

Your ISP's local server also contains an e-mail server with your mailbox (and hundreds of others), and a news server containing local copies of newsgroups. Your ISP usually gives you a megabyte or so of your very own space on the main server, usually used for your personal web page, although you can also use it as a place to back up valuable documents or whatever.

With that traditional picture in mind, let's look at WebTV. Here you purchase a 'set-top box', which looks much like a cable decoder or satellite receiver or VCR. This sits on top of your telly, and on top of the video as well if there's already one there. The WebTV box has video and sound outputs which can go straight into the TV if it can accept them; otherwise you need a modulator to feed them into an unused TV channel. Many VCR's can serve this purpose. Also on the back of the set-top box is a connection for a phone line.

The set-top box ('Internet Terminal' is its official name) retails in the USA for US$299, about a third the price of a cheap computer. On top of this there is a subscription fee of US$19.95 a month, for unlimited Internet access. Financially, this would be a very attractive proposition, especially in Australia where some ISPs still charge by the minute.

WebTV showing on an old TV set. The set-top box is sitting on top of the VCR, above the set.

The Philips/Magnavox Internet Terminal, on top of a beat-up old VCR, and with the optional WebTV infrared keyboard in front.

The standard user interface for WebTV is an infrared remote controller, exactly like the one that comes with your TV or VCR. And with this you can surf the Internet. When you turn on the set-top box, the normal TV picture is replaced with a WebTV opening screen, and soothing music comes forth from the telly's sound. At this time the set-top box makes a phone call to a toll-free 800 mumber, and here's where the clever stuff starts.

When the 800 number answers it sends a query back to the calling number, a form of caller-ID, to figure out where the call is coming from. It then sends information back to the set-top box, telling it the nearest local access number for WebTV. The set-top box then dials the local number. (Trouble is, many areas do not yet have local numbers, creating a messy problem which we shall discuss shortly...)

When your WebTV connection is established, you are presented with a menu screen. The remote control unit has up-down-left-right buttons, and you can use it to zap around the screen, just like with a mouse. You can then click on your choice to select it.

Amongst the choices are a search engine, to find interesting Internet sites; a 'favourites' area, where you can store the sites you like; and an e-mail service. The e-mail is particularly attractive — it's very easy to use, and comes with up to six separate e-mail addresses; one for every member of the family. And you don't even need to remember to 'check your e-mail'. Even when it's switched off, the WebTV box periodically wakes itself up to phone the server and check for mail. If any mail is present, the red light on the box comes on to notify the user.

But how do you type out an e-mail message or reply, when your only user interface is a TV-style remote? The hard way, that's how. The screen presents an image of a computer keyboard, and you use the remote to move around it and click on each letter of your message.

Visible in this screen shot is a (badly focused) web page — in this case, it's part of Tom's own personal web site.

It's very slow and frustrating, but there is an option: an infra-red keyboard. That's another $89.95, but I suspect that every WebTV user will buy a keyboard once they try to send e-mail a few times by pointing and clicking letter by letter. The keyboard in fact is very nice; small and light, just right for sitting on the lap.

Pros and cons

Current Internet users will know how to get to interesting sites. Most times you know the URL of the site (technobabble for the address of that site on the Internet). I don't know what it's like in Australia now, but here in the USA most advertising you see on TV and in magazines includes the Internet address of the business being plugged.

In browsers such as Netscape and Microsoft Explorer, there is a place to type in the URL you want, and then the browser takes you there. But WebTV has no such facility; the only way to enter a URL is to feed it to the search engine and hope for the best. This produces some strange results; when I tried to find our local ISP 'olympus.net', I was offered a turkey farm as one of the choices...

Traditional browsers also have that line of icons along the top of the screen for such things as moving forward or back a page, or going to the home page. WebTV does not have these on the screen, but there are special keys with the same functions on the infra-red keyboard. This is a very nice touch.

What WebTV doesn't have is internal storage for the user, such as a hard disk. So you can't use WebTV to download programs from the Internet. Then again that wouldn't be an issue because there is no computer to run programs on. But it would be nice if you could download documents and stash them somewhere. That's the way I research articles like this one — download all the information I can find on a subject, and then keep the files handy as I write the article.

At this stage you can't even print the information and store it on paper. WebTV has no connection for a printer; it's planned to offer a printer module later on which will 'allow the use of virtually any printer'.

WebTV faces one big problem that traditional computers don't — the lousy picture quality of most TV sets, especially if they are a few years old. WebTV overcomes this by presenting everything in a large text font, but that's not always good enough. The screen shot with the *Electronics Australia* logo was taken from a fairly elderly telly with bad dynamic convergence problems. The text is readable in the centre of the screen, but unreadable at the left and right sides. It seems the only solution to this would be to toss out that old set and get a new one.

Under the bonnet

So what's in the magic box? WebTV makers point out that it isn't just a

WEBTV: it could come to a TV set near you!

stripped down, cheapened computer. In fact, it appears to be one very sophisticated device indeed.

First, the microprocessor. It's not a type used in standard IBM-PC's or Macs. Instead, it's a '112MHz 64-Bit IDT R4640 Orion MIPS RISC CPU with digital signal processing extensions'. Note that it's 64-bit, and RISC, which is reduced instruction set technology — the very latest for speed and efficiency. The CPU is coupled with two megs of SGRAM, one meg of Flash ROM, and two megs of Mask ROM. Something called 'PhosphoRam on-the-fly image decompression technology' minimizes memory consumption.

The Flash ROM contains a large part of the set-top box operating system, so, in theory at least, it never becomes outdated. When a new firmware release comes along, the WebTV server automatically loads it into the set-top box; the user need never know this has even happened.

The WebTV's modem is somewhat unusual. It's a 33.6Kb/s unit, using an arrangement where it works in conjunction with the telephone company's call-waiting service. If someone is on the phone when you power-up the WebTV, it refuses to start; thus it causes absolutely no disruption to an in-progress phone call.

If a phone call comes in while WebTV is on the line, it discreetly hangs up, lets the incoming call come through, re-establishes the modem connection when the call is finished, and tells the browser to pick up where it left off when it was interrupted by the phone. The idea is to totally eliminate the need for a second phone line just for Internet use. Whether this technology will work with the Australian telephone system remains to be seen.

Even though WebTV's picture quality on an old TV leaves a lot to be desired, it does have the ability to produce much higher quality with an up-market video monitor such as might be part of a home theatre system. The video spec is 'D1-class, 4:2:2 video output (digital studio quality)' with NTSC, PAL and SECAM support, including patent-pending Worldscan technology which 'formats Web content to appear optimally in all TV formats'. And if that's not enough, 'TVLens image enhancement technology eliminates interlace flicker without blurring, while perceptually enhancing image detail'.

Output is via the usual composite

A screen grab of a WebTV menu screen, from the WebTV company's own web site.

video connector, and there is also an S-Video output, a system where picture components are sent separately instead of combined in 'composite' video. S-Video is common in video editing systems and in the enormous 'home theatre' TV systems that are gaining popularity in the USA. What we're talking about is wall-to-wall Internet.

And for those big home-theatre speakers, there is 44.1kHz 16-bit stereo audio output providing CD quality sound. The

An image of a WebTV set-top box, downloaded from the WebTV company web site.

WebTV sound is rather impressive, even on a beat-up old TV set.

Smart card slot

WebTV also has something you won't see on traditional computers for some time yet. Right in the middle of the set-top box is a little door which opens to reveal an ISO Smart Card slot, which supports ISO-compliant Visa, Mastercard, cash card and ATM smart cards. This is obviously for on-line purchases, but how this Smart Card reader will be put to use is a bit of a mystery.

Neither my local distributor nor the WebTV telephone support service knew what the card reader was actually for. They did confirm that the card reader exists (you can see it through the door) but apparently the software to drive it hasn't yet been written — or even planned. This is one of those things that will be upgraded online if and when it ever becomes a reality.

It appears that some things do indeed get upgraded. The early documentation on the WebTV Internet terminal said it was hoped to add support for Real Audio as one of the first upgrades. Real Audio is a system by which radio programs, or even things like Dallas Air Traffic Control signals, can be sent to listeners via the Internet.

While I was fooling around with an early-release WebTV terminal, just for fun I went to a Real Audio site to see what would happen. What happened was that music started playing through the TV's speaker — and very nice quality it was, too. More recent WebTV technical data says Real Audio IS supported, so somewhere along the line that set-top box got upgraded.

This isn't the total extent of the set-top box. The existing unit has a 1.8 Gigabit-per-second WebTVPort expansion connector which will allow external peripherals to be added. We're probably talking about things that haven't even been invented yet, but one early use for this connector will be a printer port.

WebTV's server

Now to the WebTV server. Instead of having Internet servers scattered all over the USA, WebTV uses a gi-normous server located in Palo Alto, California. This server contains all user e-mail boxes, and such things as a backup of each user's 'hot list' of favourite web sites. The server is reached by dialling into one of the many local ISP's who have done a deal with WebTV to let its customers use the ISP's modems and router, to get onto the Internet and then into the WebTV server.

The collection of contracted local ISP's makes up the WebTV network, which now covers about 95% of the USA with toll-free local access phone numbers. But for the other 5%, things are a bit grim. They must either cop trunk-call charges to phone WebTV, or they can set up their own Internet access with a local ISP and then access WebTV through the 'net.

BUT users who do the latter are up for the local ISP's full subscription rate, perhaps $25 a month, and then a $9.95 a month WebTV surcharge on top of that. Many people feel that if they must pay for a full-service local ISP, they may as well go ahead and get a computer and forget about WebTV. Those in the know say penetration of WebTV into these areas is very weak indeed.

The Philips/Magnavox set-top box includes a Smart-Card reader, although the purpose of this hasn't been made clear as yet.

However one area where WebTV is finding use is as a second Internet account. People who already have computers continue using them on the Internet, but they buy a WebTV unit for the kids to use, and get them their own $9.95 a month subscription, accessed through their existing Internet account. WebTV is very kid-friendly, and it even features sofware features as standard which can block child access to unsavoury sites, and to e-mail altogether if that is desired.

There are some WebTV features that may ring a few alarm bells where privacy is concerned. The server has an 'integrated monitoring and tracking system which instantly notes any service component problem, and supports logging of information of client and server for demographic compilation'.

This means WebTV can take note of your interests, according to Internet sites accessed, and feed you specially selected commercials based on those interests. It also means if you regularly access porn sites, you could well have a 'dirty old man' designator attached to your account.

Social implications

WebTV adds a whole new user base to the Internet. Its purpose is to attract TV viewers away from their soapies and sitcoms and onto the Internet. And WebTV's promoters seem to feel it is necessary to 'dumb-down' the Internet to make it appeal to TV viewers.

Although WebTV gives access to the total Internet, just as a computer does, the WebTV organization is suggesting there should be special types of sites specifically targeted at WebTV users — in other words, heavy TV viewers. A 'style manual' has been released for developers of these special pages. Here's some of its advice:

Try to reduce the number of items on your page because television audiences are used to looking at one focal point.

Pages should contain as few form elements as possible because these elements can quickly become overwhelming to non-computer users.

and most telling...

Use background music or theme music to provide an experience more like television.

Who thinks the next suggestion will be canned laughter? This whole business is reminiscent of a comment by Dame Edna Everage about what makes good television: "Make sure there's plenty of colour and movement, and they'll watch anything!"

If WebTV does become very popular, and every indication is that it will, it would be a crying shame if ALL site designers started dumbing-down their content too, hoping to please a perceived 'dumber' audience. But are these WebTV users really dumber? Or are they just not computer literate, and have no desire to be? Maybe THEY are the ones with intelligence!

Sadly, there are already signs of discrimination against WebTV users amongst 'real' Internet users. WebTV people are easy to identify; their e-mail addresses always end in '@webtv.com'. And sometimes they are being made to feel unwelcome.

While researching this article, I kept an eye out for @webtv.com addresses on e-mail I received. Then I would send them messages, asking about their experiences with WebTV. One recent response included the comment:

"...there is a recurring thread on the WebTV newsgroup about WebTVers being flamed because of their [webtv.com] domain. It may just be a case of newbys not following netiquete, and I remember AOL [America Online] members going through the same kind of rejection... not a big deal in the long term and anybody on either side who actually would give a (deleted) about such an issue needs to get a life..."

In the USA, the potential WebTV audience is the target of many selling techniques, such as through discount home electronics retailers and mail order. A very popular method uses one of the most powerful pyramid selling schemes imaginable. You can become a WebTV 'Internet Consultant', flogging the things to the public. If you can talk some of your customers into becoming 'consultants' themselves, then you can

(Continued on page 35)

The Philips/Magnavox optional keyboard being used to send an e-mail message via WebTV.

BROTHER'S MFC-1970MC 'MULTI FUNCTION CENTRE'

Is it a phone? A fax? A copier? A computer printer? Brother's new Multi Function Centre is all of those, and more — and all for a surprisingly low price. Here's a hands-on report.

by BARRIE SMITH

If you're like me, you already own a fax machine — of varying sophistication. Most offices also have a copier, a scanner and a laser or inkjet printer, as well as a phone system — again of varying sophistication. Into the scene comes Brother's Multi Function Centre (MFC), which promises to supplant all these devices as well as perform the tasks they currently perform, only even better.

As most businesses seem to have all the running gear they presently need, it would appear that Brother Industries is attacking the replacement market for phones, faxes etc — as well as chipping away at the home user who, these days, has surprisingly complex needs in this cyber world we have collectively embraced.

The Brother MFC-1970MC unit offers a startling range of attractions, most of which will be of use to many people. For an RRP under $1000 the MFC will operate as a high speed 14.4kb/s plain paper fax modem (9.6kb/s to most machines), a message centre, a computer-linked printer, 400 x 400dpi scanner with supplied OCR software, a reducing/enlarging copier — oh, and a phone and digital answering machine. The phone, by the way, can also be operated as a hands-free speaker phone.

It provides quite a load of worthwhile features, and all bundled into an attractively priced package. Compare: a plain paper fax/phone and answering machine can cost anywhere between $650-1400, a copier can set you back nearly $700, while a bottom line printer for your computer may be yours for around $300. Throw in a package of Textbridge OCR software (as supplied with the MFC) and you're looking at another $90 or so. So the total, at minimum, would be well over $1700.

The Brother MFC-1970: many of the facilities needed for the home and small office, in a very affordable package. It prints on plain paper at 200dpi using a carbon impregnated ribbon.

Features

So, what can't this wonder appliance do? Well, it probably won't balance the books — although I must admit, I didn't push it too far!

First the fax: with 1MB of internal memory, the MFC can hold up to 50 received fax pages, for later printing (if you're temporarily out of paper). It can hold 200 pages of blank A4 paper for incoming faxes, whilst holding 20 printed pages of outgoing faxes on a document feeder. A total of 24 one-touch and 100 speed dial numbers can be held in memory. Distinctive ring detection differentiates between a fax and phone call. Fax transmission can transmit in 64 shades of grey, and also superfine resolution for fine print.

There are seemingly dozens of other

refinements — such as multiple resolution transmission, smoothing, next fax reservation, delayed transmission, etc — all designed to make the delicate art of faxing proceed with minimal fuss. And one interesting mode is 'super quick scanning', which prescans the fax into memory prior to transmission.

Next, the phone and its internal digital answering machine. This stores up to 30 minutes of voice messages; you can set up five digital mailboxes to store private phone and fax messages; voice-on-demand allows callers to access voice messages in up to 50 memory boxes, as well as allowing remote voice and fax retrieval plus remote notification of incoming voice/fax.

But for many, the big attraction of the MFC is its computer connectivity. This is via a supplied RS-232 twin lead cable (9 or 25 pin) and software you can link into an IBM compatible, running Windows 3.1/3.11/95; from here you can transmit and receive faxes and also treat the MFC as your dedicated printer.

Arguably more useful is the MFC's role as a scanner, allowing you to dump text and graphics directly into your computer. As many have found these days, even the 'no frills' OCR software packages do a damn fine job on most typewritten text, so the inclusion of the highly regarded Xerox TextBridge package is a definite bonus.

Installing it

I must admit to gritting my teeth whilst supplanting my three year old, sadly outdated $1200 Panasonic thermal fax/phone machine with the Brother MFC. Out with the old — at least for a week or two — and in with the new. I desperately hoped that 'new' didn't mean Byzantine setting-up procedures that would make the whole business a journey into the impenetrable. Whilst enjoying the life of a technical reviewer, I have to admit I do like my office hardware to run like the proverbial Hornby train — with no stops and no crashes.

The footprint of the MFC is above average, but then you make savings by dint of the unit supplanting up to three other units. The control panel is simply set out, with large easy to read text on healthy sized buttons. Aside from the usual 12 button dialing section there is a One Touch area, offering access to a total of 24 preset numbers. Surrounding these two access zones are sundry buttons which perform such tasks as redial, copy, start, etc — as well as the more unusual functions of record, erase and play (for the answering machine).

There are three phone line access points: line in, handset output and extension output. At the side is another connector, for connection to your PC.

Hooked up, and with power switched on, I was ready to try some test transmissions and receptions — with the willing co-operation of my Panasonic fax machine, now relegated to a second phone line. There followed some text and picture send/receives, using a page from an Asian business magazine, containing some crisp, clear sans-serif text and a grouping of halftone colour photographs. You have virtually four options when sending a fax: standard (3.85 lines/mm), fine (7.7 lines/mm), superfine and photo (each 15.4 lines/mm) — each is progressively slower, until a full A4 page of photographs can take 3 - 5 minutes. More of that later.

Having quelled my curiosity, I then decided it was time to set up the machine properly, to not only distinguish incoming voice from fax signals, but to also handle unattended phone calls. Via a simply configured menu system — displayed on the 10 x 55mm LCD screen — and a little more than 15 minutes later, I was up and ready to send to and receive from the rest of the world. A great deal of credit for the ease of setup can be allotted to the lucid and comprehensive instruction book.

Taking matters further, I then installed the MFC's software and OCR program (on a total of four floppies) onto a Windows computer. No hassle here, and I was soon sending faxes out from the PC and receiving same from my faithful Panasonic fax machine.

OCR is a heady task these days in most offices. Unless you have a fast scanner linked to a rapid PC you can often find the output speed sinks below that of a reasonably adept copy typist. However, if you are in the two fingers brigade, like me, and hate copy typing, any speed is a boon.

I'm glad to say the TextBridge software worked well, within its limitations — or perhaps I should say 'limitations which are beyond its control', such as poorly faxed data or type of a size which falls beneath the resolution level of the MFC unit.

Fax/copier quality

Now back to the faxes I sent and received. Whilst not holding up my trusty Panasonic as the gold standard, nor even claiming it as the one to beat, I felt it was a good example of a recent machine of high quality when purchased, and costing around $200 more originally than the Brother MFC.

In copier mode the Panasonic performed better, with more clearly defined text. In sending a fax, in standard and fine resolution the two machines matched nearly exactly; with the halftone setting in play the Panasonic transmitted a poor, near unusable image, while the Brother (in photo mode) sent a superb halftone image across the wires — although it has to be said that the text section of the page was received as a grey image. So, overall, the Brother MFC could be said to be the superior performer.

Operating costs

Of course, running cost comes into the picture. The MFC, whilst claimed to be a plain paper copier is not a laser printer; instead it uses a wide length of carbon impregnated ribbon. So while the output matches a laser printer in terms of blackness, it suffers from a lower resolution — 200dpi.

An MFC ribbon cartridge refill costs $31.50. Expect to get some 420 pages with each. So the final cost, including plain A4 paper (at around 1.5c a sheet) would be 9c per page.

Compare this with a thermal fax unit, using coated paper: a 30 metre roll costs around $4 a roll, from which can be expected a total of approximately 100 pages. Therefore, a sum total of 4c per page can be expected.

Summarising...

There is no doubt the Brother MFC is an excellent, elegantly designed unit, capable of performing a multitude of tasks and demanding nothing spectacular in the way of operator proficiency. If you're in the market for this type of unit for your home or office, it would be well worth considering. ❖

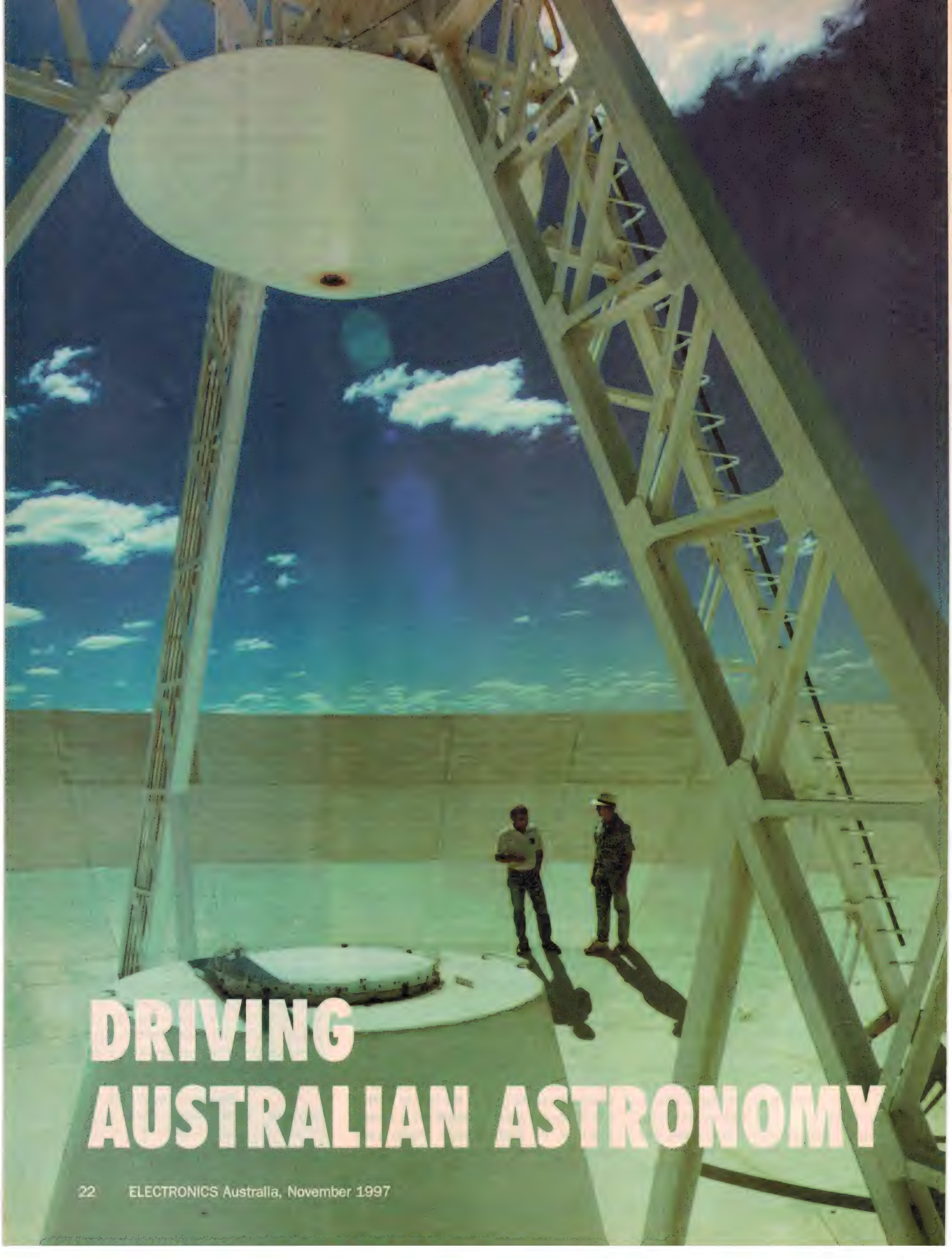
Brother MFC-1970MC

A combination phone, digital answering machine, plain paper fax, scanner and copier in a single unit measuring 385 x 378 x 213mm (DxWxH), without paper tray. Weight is 5.2kg.

Requirements: IBM PC 386 (DX 33MHz) or higher, Windows 3.1X or Win 95, a 9-pin or 25-pin RS-232 serial port, 8MB minimum RAM (for optimum OCR performance) and 10MB minimum hard drive space.

RRP: $999.

Available: Brother Industries, 7 Khartoum Road, North Ryde 2113. Phone (02) 9887 4344 or fax (02) 9888 9707.



DRIVING AUSTRALIAN ASTRONOMY

Officially opened in September 1988, the Australia Telescope Compact Array in Narrabri, NSW is the only radio telescope of its kind in the southern hemisphere. Using six dishes 22m in diameter, it can be used as synthetic dish 6km in diameter — and when hooked up with the dishes at Coonabarrabran and Parkes, to create a virtual dish 300km in diameter. Much of its technology was pioneered by the CSIRO, and it's being used for leading-edge astronomy...

by GEOFF McNAMARA

I gently lifted the lever, and was immediately deafened by a horn more suited to a Mack truck than a research instrument. Startled, I let the lever go. "You have to keep your finger on the lever", the engineer explained. "It's like a deadman's handle on a train."

The lever only has two directions, east and west, and they haven't even bothered to label 'west'. I pressed it again and the deafening horn returned. After a few seconds the sound ceased; there was a brief, silent pause and then the giant antenna began to move. Almost silently and with hardly any vibration, the 230-tonne radio dish accelerated to a fast walking pace.

I felt like a kid allowed to drive the car for the first time! Here I was, a mere taxpayer, driving one of the six 22-metre radio dishes that make up the Australia Telescope Compact Array...

Near Narrabri in northern New South Wales, the Australia Telescope Compact Array (ATCA) is the only telescope of its kind in the southern hemisphere. The array is a synthesis telescope, a series of 22-metre dishes capable of mimicking a single dish up to six kilometres in diameter. Alternatively it can be used in conjunction with radio dishes at Coonabarrabran (another 22-metre dish) and Parkes (64 metres), in a configuration known as the Australia Telescope Long Baseline Array (ATLBA). In this mode, the combination of instruments carry out the work of a single antenna 300 kilometres across.

The ATCA and the Australia Telescope were originally conceived in the 1970s. One of the early players in the story was Dick Manchester, an astronomer at the Australia Telescope National Facility which operates the ATCA. Manchester has had a long term association with the Australia Telescope.

"I was one of two or three people who had the idea of the Compact Array", Manchester recalls, "along with Miller Goss and Cal Wellington, and Brian Robinson also played a fairly major role in supporting it." It was Manchester and his colleagues' foresight that paved the way for the ATCA: "I could see for astronomy to progress in Australia, we had to have an instrument like the Australia Telescope", said Manchester, "that's why I pushed it."

The opportunity to build the ATCA came in the 1980s when it was decided to close down a radioheliograph — 96 dishes arranged in a three-kilometre diameter circle intended specifically for observing the Sun — at the Paul Wild Observatory near Narrabri in northern NSW. It was a difficult decision to make, considering the fact that the radio heliograph was still producing scientific results. Nonetheless, the decision was made to close the radioheliograph — a decision which attracted the wrath of the international astronomical community — in order to free up limited Government funding for astronomy.

An even more difficult decision was what to do next. To maintain our world status in radio astronomy, a new radio telescope was needed that would satisfy not only the needs of contemporary astronomy but future research as well. It was decided to build a telescope which would extend the capabilities of the Parkes dish.

The new instrument was based on the idea of *aperture synthesis*, a technique pioneered by Australian astronomers in the 1940s. Synthesis telescopes use a series of separate dishes to simulate the 'edges' of a much larger single dish.

A proposal for an Australian Synthesis Telescope at Parkes, using the 64-metre dish as the primary instrument and an adjacent series of smaller, movable dishes, failed to win Government support. An added problem was the looming prospect of a new mine not far from the site, which could have produced a great deal of radio interference.

A key player in the project from the start was Dr Bob Frater, who recalls that when he and his colleagues looked at the spacing between the site of the old radioheliograph at Narrabri, the Anglo-Australian Observatory at Coonabarabran and the Parkes Observatory, he noticed it was ideal for a long baseline interferometer. So it was decided to build the Compact Array at the Narrabri site. The Compact Array could then be linked with radio dishes at the other two sites to form the Australia Telescope. It was also planned from the start to occasionally make use of Tidbinbilla's US-owned Deep Space Tracking Station.

Building began in 1984

The Australia Telescope Compact Array was funded in 1983 with construction under the management of the CSIRO begun in 1984. Four years and $50 million later, the telescope was officially opened in September 1988.

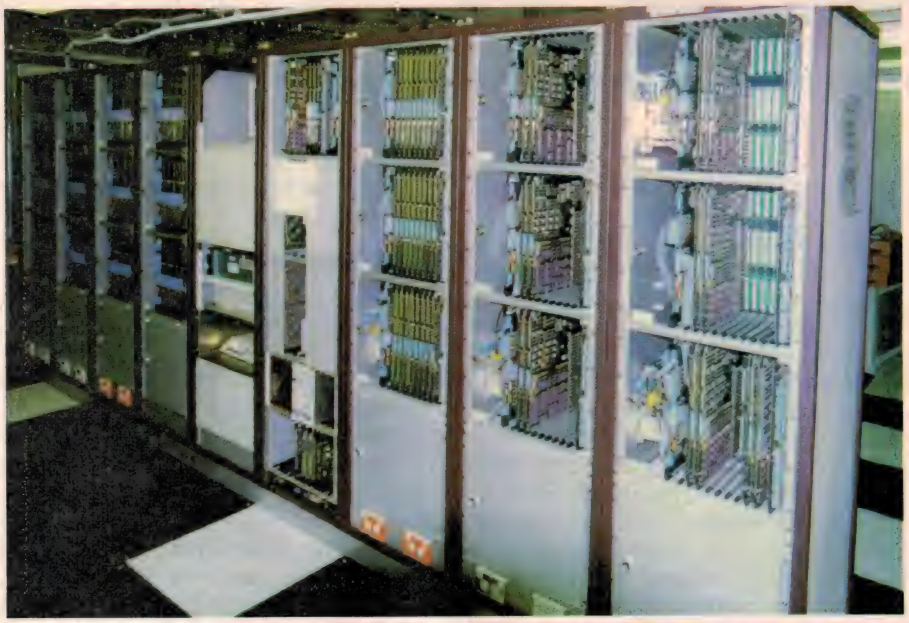
The six 22-metre dishes that make up the ATCA are arranged along a six kilometre baseline. (A baseline is the straight line between two observational points. In the case of radio astronomy, the longer the baseline the finer the detail visible.) Five of the dishes are moveable along a three-kilometre stretch of track, with the sixth on its own short 75-metre stretch of track three kilometres to the west.

Dr John Whiteoak, officer in charge of the Paul Wild Observatory which includes the ATCA, explained that because the dishes are arranged along a single line, the telescope can't take two dimensional snapshots of the sky: "We only get good detail in the direction in which our baseline is projected on the sky. We rely on the rotation of the Earth to rotate our baseline."

Seen from space, the line of antennas rotate with the Earth so that they appear to trace out a circle. Whereas an optical telescope can produce an image of an object straight away, astronomers using the ATCA must wait a full 12 hours before a good two dimensional image can be produced. "If ever we take a five-minute snapshot (without waiting for the baseline to rotate), we have good resolution in one direction and bloody awful resolution in the other direction", Whiteoak said.

The aim of having the telescopes moveable along a track is to create different telescope 'apertures'. The closer the telescopes are together, the lower the resolution; spreading the telescopes apart permits greater resolution. Both are needed to create an image. Various combinations are used for work at a variety of wavelength and resolution requirements, depending on the needs of the astronomers.

After a 12-hour observation, the dishes will have traced out a series of arcs on



The ATCA's Correlator, a special-purpose computer for processing and multiplying the signals from the receivers in each dish antenna. Each antenna has four different IF channels, and the correlator processes some 256 megabits of data per second. (Photo: G. & B. McNamara)

the sky as might be seen by a partially filled dish 6km in diameter. By moving the dishes to new locations, the rest of the 'synthetic dish' can be filled in.

Optical fibre links

The dishes are linked via optical fibres, but of course the use of optical fibres was very much 'under development' when the ATCA was being built. "The use of optical fibres rather than the normal black radio cables was a first in radio astronomy", Whiteoak recalls. The aim was to have wide bandwidths of 256MHz available, since wide bandwidths meant greater sensitivity for some observations. Further, the Compact Array called for small diameter optical fibres that could transmit these wide bandwidths over the maximum 6km-spacing of the antennas.

The problem with the ATCA was that in those days the wider the optical fibre, the less likely it was capable of passing wide bands over such a long distance. "Because we used narrow optical fibres we could transmit these wideband signals", said Whiteoak.

Because the dishes can be moved — a process that is repeated every two weeks on average — the fibres have to be unhooked and reconnected at one of the 35 'stations' available along the track. Each antenna is linked with the control room by plugging its optical fibre link into one of the stations. The repeated clipping and unclipping of the fibres meant the connectors had to be robust. "The ones we finally got were used by the French Army", said Whiteoak, "and they were so robust — so we were told — that tanks could drive over them and they'd remain undamaged!"

From the control room, optical fibre links the ATCA with the ATNF's headquarters in Marsfield (Sydney). The whole array can be operated from Sydney, and about 15% of the observing is carried out from Marsfield.

The ATCA is a typical example of Australian astronomy in that, what you can't pay for, you have to do yourself. The dishes themselves are a good example. The panels that make up the dishes — 150 of them for each 22m dish — had to be bent in two dimensions. "When we started there was no industry in Australia that would do this at a low enough cost", Whiteoak recalls.

What the CSIRO scientists and the consulting engineers, Macdonald Wagner (now Connell Wagner), finally came up with were a couple of simple techniques. One was a stretch-bend machine that took I-profile aluminium girders and bent them to form the backing framework of the dishes.

To bend the aluminium plates that would form the surface of the dishes, the engineers invented a 'bed of bolts'. "It was just like an Indian bed of nails", Whiteoak explained, "but it was actually a mould in which the bolts could be set at the right height so they formed a two-dimensional curved surface."

The 2m x 1.5m aluminium panels were laid onto the bed of bolts and a vacuum ("We tried using bricks at one stage, but they didn't work", chuckled Whiteoak) forced the panel into the desired shape. It was then glued and riv-

Because the distance from each ATCA antenna to the correlator varies, this rack of delay equipment is used to adjust the timing of the signals for synchronism. The signals appear at the patchboards at each end. (Photo: G. & B. McNamara)

eted to the framework. This same technique — because it uses semi-skilled labour, is cheap and effective — is now used by private industry to make dishes for communications antennas. "A number of overseas communications antennas have been built by Australian manufacturers, based on the ATCA antennas", said Whiteoak.

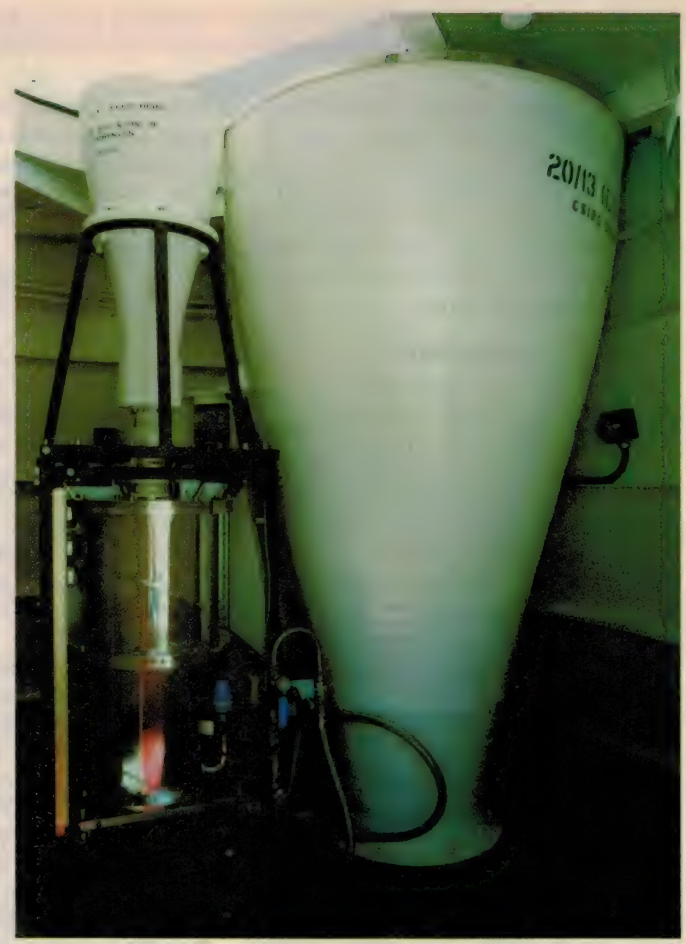
Each of the dishes called for a large, 2m-tall feed system for observing simultaneously at 13cm and 21cm wavelengths. The feed is the device that sits at the focus of the dish, collecting the focused radio waves and feeding them to the receivers.

"The conventional way of doing this was just to carve it out of a huge block of aluminium", said Whiteoak. "Now you can just imagine how large a block you'd need, not to mention the time and effort needed." To save money, the engineers came up with an alternative method of constructing the feed out of strips and aluminium rings held together with fibreglass. "This provided a light, simple to build feed system", said Whiteoak.

"People laughed..."

The approach was criticised by others in the field. "People laughed at us, saying it wouldn't work because we were just mechanically holding the bits together with fibreglass... But in the end this technique was taken over (by the US astronomers) for the design of their 'Very Long Baseline Array' (a larger version of the ATCA)." The design has also been used by Italian astronomers.

Receivers used in radio astronomy have to be cryogenically cooled. Since from time to time astronomers like to use different receivers on the same dish, changing over receivers in a cooled system is a major operation. To get around this problem, the ATCA dishes have two cooled receiving systems built on a rotating turret, with provision for more. Each time an astronomer wants to observe at a new frequency, the turret rotates the desired receiver into position. (This technique has been refined for use in the 'translator' now in use on the Parkes radio telescope — see *EA* April 1996.)



Above: two feed horns mounted on a turntable at the focus of one of the ATCA dishes, with the smaller horn in operation. Left: the receiver front ends are below the turntable. Visible at right is the L/S band receiver, with its A/D converter on the left. (Photo: G. & B. McNamara)

One of the unique features of the ATCA is its ability to observe at four frequencies during any one 12-hour observing run. This is made possible by using the ATCA's two dual-frequency systems. "One simultaneously covers 21cm and 13cm, while the other covers 6cm and 3cm", Whiteoak explained. "Because these dual frequency systems are mounted on a rotatable turret, we can move from one pair to another in about 15 seconds."

This allows an astronomer to make dual polarisation observations at four different frequencies in one go. "I don't believe there's any other array that can currently do this," Whiteoak added.

The amount of data streaming in from the six antennas is prodigious. The signals are sent to a computer called the correlator, which multiplies the signals 256 million times a second.

At the heart of the correlator is a very large scale integrated (VLSI) chip. When the ATCA was being built, however, the technology in this area wasn't as developed as it is today. In fact, the VLSI chips used in the ATCA had to be developed in-house because there was simply nowhere else to go.

"We didn't know when we started out whether we'd be able to make these chips", Whiteoak recalls, "It would have been a tragedy had we not been able to."

Nonetheless, they managed to create a 50,000 transistor

chip "...which exceeded our specifications. We were designing them to work at 10MHz, and found that the ones we built worked up to 20MHz", Whiteoak said. This enabled the astronomers to increase their final bandwidth from 160MHz to 256MHz, using 16 chips in series.

Unique instrument

The ATCA is a unique telescope in a unique place on Earth. "Of course the main advantage of the ATCA over other arrays is that we've got the southern hemisphere", said Whiteoak. There are many objects of particular interest that are best viewed from the southern hemisphere, such as the core of the Milky Way galaxy and two of the nearest external galaxies to our own — the Large and Small Magellanic Clouds.

Astronomers have taken advantage of the ATCA's location by making a high resolution map of the Magellanic Clouds using one of the techniques pioneered at the ATCA, called 'mosaicing'. This technique involves observing a series of points on the sky for a few seconds each. The combination of these points creates an image much like a pointillist painting. The radio images produced in this fashion have a high resolution and high dynamic range.

One of the best examples so far is a map of hydrogen in the Magellanic Clouds. The high resolution of the images is revealing interesting structures which can then be compared with optical images, allowing study of the movement of features within the Clouds.

One of the most interesting demonstrations of the ATCA's abilities has been the creation of a three-dimensional image of Jupiter's radiation belts. Bob Sault, a radio astronomer at the Australia Telescope National Facility, explained that Jupiter's rapid rotation allowed him and his colleagues to create a unique image of Jupiter at radio wavelengths: "Normally the ATCA gives us a two-dimensional image like an ordinary photograph. But because Jupiter spins, we have information in three dimensions."

The process is similar to medical tomography, where three-dimensional images of a patient's insides are created using X-rays. "We've produced a three-dimensional recreation of the radiation belts", Sault continued. "It works because the radiation belts are transparent."

The three-dimensional image is actually the by-product of an entirely different project. In 1994 the comet Shoemaker-Levy 9 slammed into the giant planet in one of the most important observed astronomical events in history. The radio astronomers' original goal was to study the effects of the impact on the radiation belts.

The initial images turned out to be more complicated than the astronomers had expected, so they made further observations a year later to help them understand what the radiation belts looked like normally. What they found in the meantime was that they could produce three-dimensional images that allow them to study the properties of Jupiter's magnetic field close to the planet, in considerably more detail than had previously been possible.

So what has the 3-D image of the radiation belts taught Sault and his colleagues? "One of the things we've learnt is that the radiation belts can be well described by considering the magnetic field", said Sault. "I think some people have tried to invent models which are more complicated than they need to be."

And comet Shoemaker-Levy 9? "One of the pre-impact predictions was that the radiation belts would dim", Sault recalled. Because the radiation belts are the result of charged particles whizzing around the magnetic field, it was expected that the dust which accompanied the comet fragments would quench the charged particles, causing the radiation belts to dim.

"On the contrary, they became more intense!" said Sault. No one agrees on why this happened, but one possibility is that the impacts interacted with Jupiter's ionosphere to help the electrons become better emitters. "Not necessarily more energetic, just better emitters", Sault said.

ATCA's future

But what of the future? Is the ATCA likely to be outshone by larger instruments, the way optical telescopes the world over have been challenged? "At the moment there's no competition", comments Whiteoak, "but there are plans by the Japanese, the Americans and the European community to build large millimetre and sub-millimetre arrays in Chile."

This would give those countries access to southern hemisphere objects, in a sense stealing the thunder of the ATCA. Further, the scale of these projects is impressive: the Japanese and Americans are not only going to build sub-millimetre arrays of their own, but they're now talking of coordinating their efforts to produce a super-array.

Meanwhile the Europeans are talking of an array of 40 to 50 antennas. All of these telescopes will go to higher frequencies than the ATCA, will have much larger collecting areas, and be located at much better sites.

To position each dish accurately at the desired 'station' along the ATCA track, for a particular configuration, a remote control handset is plugged into a box at the base, near the datum marker. (Photo: G. & B. McNamara)

Four of the ATCA's six 22m dishes, pictured at one end of the 3km stretch of the track. They may not look all that large here, but as the photo on the first page of this article shows, they're really quite massive. (Photo: G. & B. McNamara)

"Once they get going, they'll blast the hell out of us", said Whiteoak. The ATCA doesn't currently have a millimetre capability, a deficiency Whiteoak is keen to see rectified. "If we can get a millimetre array up quickly, then we can scoop some of the cream as well as get experience in techniques at these short wavelengths."

Whiteoak is hopeful that this will be achieved within the next five years or so. A contract has recently been signed to provide funding to upgrade the ATCA's capabilities down to 3.5mm wavelength. "The goal was to reach the wavelength at which many molecules radiate", Whiteoak explained. The common carbon monoxide line is important as a tracer for interstellar molecular clouds; molecular hydrogen in cool clouds doesn't radiate at radio wavelengths.

Ironically, funding for the upgrade came as a result of the Australian Government's decision *not* to provide funds that would have allowed Australia to join the European Southern Observatory. The money comes from a $65 million Major National Research Facilities scheme. Although the bid by Australian astronomers to join the European Southern Observatory in Chile failed — a bid which was fully supported by Australia's radio astronomers — the ATNF and the University of Tasmania were given more than $9 million to upgrade the ATCA and Australian VLBI facilities.

As well as giving the ATCA millimetre capability, the money will be used to provide the array with more stations for greater flexibility, to make improvements to the single 22m dish near Coonabarabran, "...and another $1.26 million to keep the overseas collaboration pot boiling. That is, to stimulate Australian collaboration with overseas groups", said Whiteoak.

Yet all this is healthy competition, Whiteoak emphasises, adding that it's important for Australians to be involved with other countries in these research fields.

"I'm very keen to get involved in the Chillean projects", Whiteoak continued. "It's going to be to our advantage to get in on the action, because this is going to be fantastic once they get going."

In the mean time, the ATCA will continue to serve as the only high-frequency synthesis telescope in the southern hemisphere. Despite the talk of overseas groups infringing on the ATCA's territory, it is still an impressive instrument, especially to a layman...

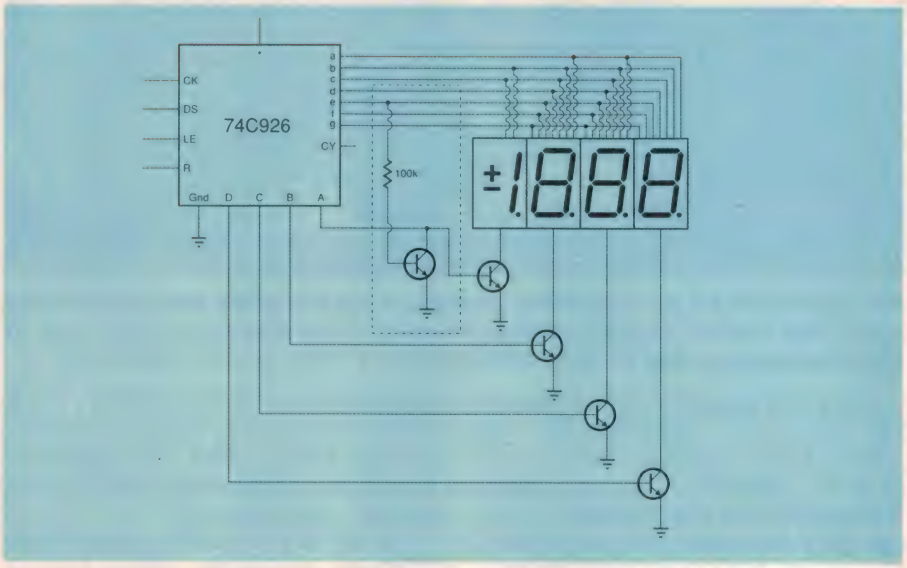
As we approached the station, the engineer took control and guided the antenna the last few metres. When the antenna was close to the station, he jumped down and, using a handset connected to the antenna by a cable, guided the massive structure into place as if he was driving a model train. When the foot of the antenna was within a millimetre or two of the station he stopped, turned to me grinning, and said: "That'll do. The rest they can sort out using the software."

(Geoff McNamara is a freelance science writer based in Sydney, Australia, and a frequent contributor to Electronics Australia. He extends thanks to John Whiteoak and Tim Kenedy for their help in preparing this article.) ❖

Circuit & Design Ideas

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

Zero blanking for 3.5 digit display



The 74C926 4-digit counter is a popular IC used in a number of counting/timing applications, but there is a drawback in using it in 3.5-digit displays in that the most significant digit (having only segments b and c), would be illuminated both when it is supposed to display a '1' and a '0'. In each case, segments b and c are on, so the digit displays a '1' the whole time!

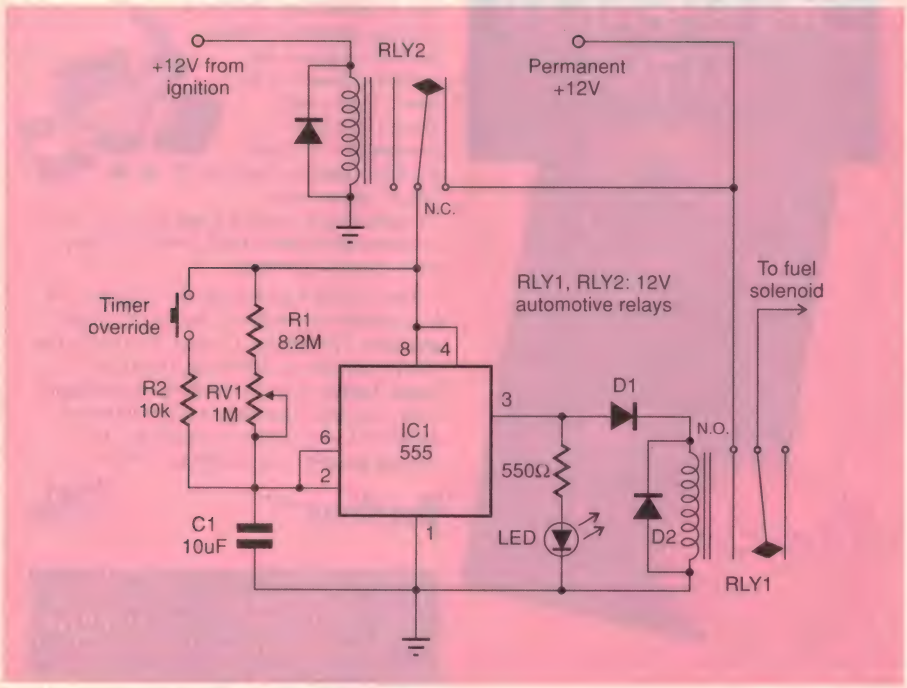
The solution is to prevent the most significant digit from being activated when any segments other than b and c are driven. An additional transistor and resistor do the trick, switching off the digit's transistor when it senses the segment e being driven. (Sensing segments a, d or f would give the same result.)

With this modification, the most significant digit will be blanked when it is to display a '0,' while a '1' will be displayed normally. Note that this circuit doesn't have any means of signalling an overrange (i.e., above 1999).

Marcin Frankowski
Warszawa, Poland **$25**

Turbo timer for diesels

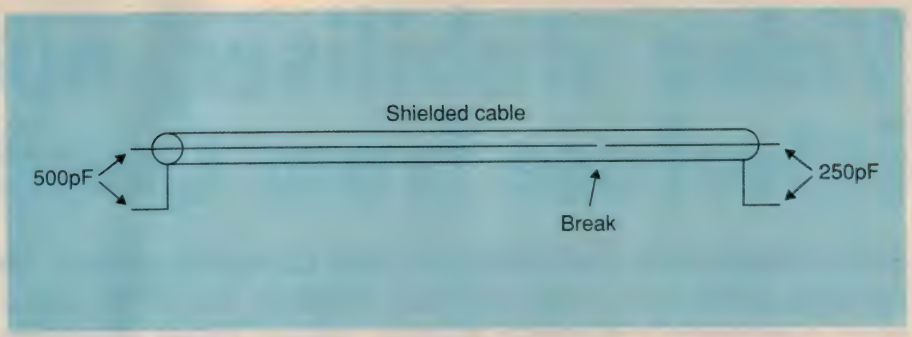
The main reason for designing this cooldown timer for diesel vehicles was that the prices for commercial units run into hundreds of dollars. For little more than the price of two automotive relays, this circuit provides a short duration time delay to enable a turbocharged diesel to keep running for approximately one and a half minutes after the engine switch is turned off, to allow the turbocharger to cool.



The circuit shown is designed to be connected in addition to the existing wiring. IC1 is a 555 timer configured as a monostable whose time delay is set by R1, RV1 and C1. Upon turning off the ignition, RLY2's contacts close, enabling the timing circuit and sending pin 3 high immediately. This turns on RLY1, keeping the fuel solenoid energised. C1 begins charging towards IC1's threshold on pins 2 and 6, and when this voltage is reached, pin 3 goes low, dropping out RLY1 which in turn de-energises the fuel solenoid and stops the engine. IC1 will stay in this condition until the ignition is turned on and off again. An override pushbutton is provided to shut the engine off sooner if required. D1-D3 protect against inductive spikes caused by the relay coils. The quiescent current drain of the circuit is less than 10mA, which won't worry the vehicle's battery.

Terry Ives
Penguin, Tas. **$30**

Find that break!



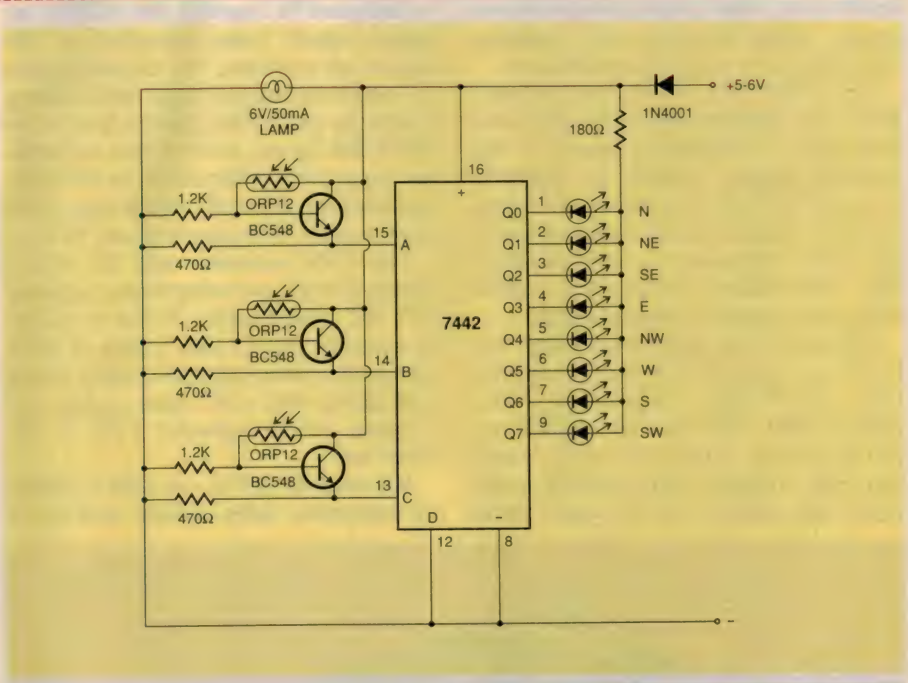
Shielded leads usually break near the plug, and so it is often a simple matter to cut the plug off 100mm from the end and re-terminate. In one case I had a cable where the break was further down the line, and so not wanting to snip bits off the end until I found it, or to use the binary division method (which ensures that the longest piece of cable left after finding the break will be at least half the length of the original cable), I applied a bit of mental effort and a capacitance meter to come up with this approach.

A comparison with a servicable piece of the same type of cable confirmed that 750pF was a reasonable capacitance in that length. So I cut at the proportional length, a third from one end in this case, and was pleasantly surprised to find that the break was within 10mm of the cut. So although shorter, the cable ended up being cut at the right place, and was restored to usefulness with a minimum of effort. Note that this method could be applied to other cables, so long as there is a reasonable capacitance between the two lines.

David Jackson
Mitcham, SA **$25**

THIS MONTH'S WINNER!

Electronic wind vane



Most mechanical wind direction meters need complicated drive systems which are prone to wear. The electronic wind vane described here offers a solution to this problem, as the only moving part is the wind direction pointer shaft in a bearing on the top of the unit.

The lamp, LDRs and transistors are mounted inside the unit, coupled via a five-core cable to the IC and power supply mounted along with the eight indicators inside the house. The way the circuit works is by using a light source mounted above a 50-60mm diameter coded disc fixed to the pointer shaft. The code for the disk is made by cutting slots over the row of three LDRs, different combinations of which are illuminated depending on the position of the shaft.

The signals from the LDRs are cleaned up using three BC548 switching transistors, which produce a logic high on their emitters if light is allowed to fall on the LDR, and a logic low if the light is blocked.

The three bits of data are then fed into a 7442 BCD to decimal decoder (the chip's fourth input is tied to ground), where the bit pattern is decoded and lights one of the LEDs to indicate the wind direction. These LEDs can be arranged in a circle so that they show the eight compass points.

To cut the coding slots, divide the disk into eight sections and mark out three concentric rings — one over each LDR. I used the following pattern where 0 = no slot, 1 = slot, and the rings are labeled A = outer, B = middle, and C = inner:

ABC	
000	**North**
100	**North-East**
110	**East**
010	**South-East**
011	**South**
111	**South-West**
101	**West**
001	**North-West**

By using LEDs of different colours, or by adding another LED in the centre of the readout, you would know the wind direction in complete darkness.

Terry Stanbury
Brisbane, Qld. **$30** ❖

WIN OUR 'IDEA OF THE MONTH' PRIZE!

As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a complete closed circuit TV system, comprising a 5" B&W video monitor, CCD video camera with stand, power supply and cabling. This system comes from our sponsor Allthings Sales & Services, and is valued at $369.00!

Video stabiliser, audio interface from Questronix

Sydney-based audio and video specialists Questronix recently sent us two of their current range of products: a low cost composite video stabiliser, the AVS2, and a two-channel audio interface unit which performs fully electronic coupling between balanced and unbalanced equipment — the AB2C.

With more and more people engaged in producing their own audio-visual presentations nowadays, the market for what was once fairly specialised AV signal processing, editing and interfacing equipment is steadily growing. As a result quite a few firms are now developing, manufacturing and sourcing interesting new products in this area.

One of the firms which saw the trend and began specialising in this area some time ago is Questronix, based in the northern Sydney suburb of Hornsby. Founded by MD Joe Raine, this firm currently offers a broad range of audio and video equipment — some of which they manufacture themselves, while others are sourced from other firms.

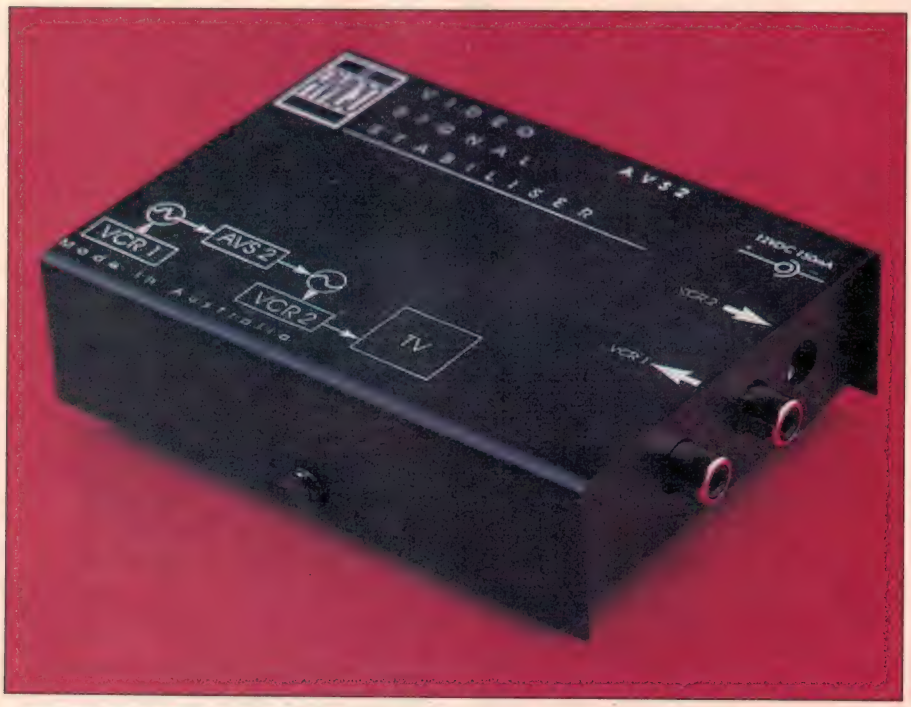
Included in the Questronix range are timebase correctors for both composite video and S-video, video effects units, genlock units, video waveform stabilisers and enhancers, mixers for audio, video and both, interface and matching units, cables and adaptors. So it's a good place to try, if you need almost any kind of AV processing equipment or accessory.

One of the products currently available from the firm is the AVS2, a low cost composite video signal stabiliser, which is sourced from Avico. This unit is designed to improve the stability of video signals being recorded or displayed on monitors, by 'cleaning them up' and restoring their sync and blanking levels. As part of this process it removes VITS test signals, teletext data and similar 'piggyback' information in the vertical blanking interval, which can cause problems for both monitors and VCRs.

The AVS2 measures only 105 x 83 x 36mm overall, operating from a separate 12V DC power supply. It has no manual controls; there's only a pair of RCA sockets for video input and output at one end, along with a DC input socket, and a green power indicator LED at the other end.

We tried the AVS2 out with a variety of composite video signals, and found that it certainly provides a worthwhile degree of 'cleaning up' the waveform — especially in the vertical blanking interval. There was a small increase in the sync tip level from the vertical sync block to the end of the blanking interval, but this didn't seem to cause any problems for the monitors or VCRs we used. With some signals we did get a small amount of colour error on the first few lines at the top of the picture, with one monitor, but otherwise there was no significant picture deterioration.

In short, we found the AVS2 a well-made little unit, and it seems very good value at the quoted price of $129. A matching 12V/300mA plug pack supply is available for $13.95. Questronix can also supply a 'big brother' version, the AVS2PRO, which not only stabilises the video signal but also provides enhancement, gain control and bypass facilities along with a second video output. The AVS2PRO sells for $289.



The AVS2 Video Signal Stabiliser, shown here only a little smaller than actual size. It's very compact, and runs from a 12V DC plug pack.

Audio interface

Another interesting product from Questronix, and one which they manufacture themselves, is the AB2C — an audio balanced/unbalanced interface. This is designed to allow the interconnection of domestic/semi-professional audio equipment (which generally uses unbalanced inputs and outputs) with professional balanced-line mixing consoles, recorders etc. A pair of the units can be used by to send audio signals over long distances without deterioration due to HF loss or injection of hum, noise or crosstalk.

The AB2C measures 146 x 195 x 44mm and includes its own power supply. It is fully electronic, with no transformers to limit bandwidth or contribute phase shifts, etc. It provides two balanced-to-unbalanced buffers and two unbalanced-to-balanced buffers, so a single AB2C could be used for one end of a full-duplex balanced stereo link, for example. Or to implement full interfacing between an unbalanced system and a professional recorder...

All balanced inputs and outputs are

The AB2C Audio Interface, which provides four high quality buffers — two for balanced to unbalanced transfer, and two for unbalanced to balanced.

via standard XLR connectors, while RCA connectors and 3.5mm stereo jacks are used for the unbalanced connections. On the unbalanced output side the 3.5mm jack and RCA connectors are simply connected in parallel, as you'd expect, but on the input side the jack and RCA inputs are actually mixed together using virtual-earth mixing — so that signals can be fed in simultaneously from two stereo sources.

Each of the unit's four buffers has an adjustable preset gain control, to allow gain matching, and it's also possible to set either pin 2 or pin 3 of the XLR connectors to be 'hot' (or in phase with the unbalanced side of the buffers). The input and output screens on the XLRs can also be disconnected from ground, if desired. It's all very flexible.

The rated wideband signal to noise ratio of the buffers in the AB2C is better than 96dB, with maximum input/output levels of +26dBu for the balanced side and +20dBu for the unbalanced side. The frequency response is from 3Hz to 50kHz within 3dB, and the adjustable gain is variable between -26dB and +10dB for the input buffers (bal to unbal), and between -5dB and +20dB for the output buffers.

The AB2C is nicely made and quite rugged, and should be very suitable for any applications which need high-quality stereo 'bridges' between unbalanced and balanced audio gear. At the quoted price of $349 it also seems good value for money.

Further information on these products or any of the other items in the Questronix AV range is available by contacting the company at Unit 2, 1 Leonard Street, Hornsby 2077; phone (02) 9477 3596, fax (02) 9477 3681 or on the web at **http://www.questronix.com.au/~questav**. ❖

Notes & Errata

'No Frills' Active Antenna (October 1997): The 47nF coupling capacitor C6 is missing from the circuit diagram on page 82. This capacitor should connect between the drain of Q1 and the junction of R8, R9 and the base of Q2. Both the PCB and overlay diagrams are correct. Also the 6.8uH inductor is listed on the overlay as L1 — this should really be L3. Finally, the ferrite material for the tuning slug of L1 wasn't specified. For best results use a slug of F29 material. ❖

AUTOMOTIVE ELECTRONICS

with JON LOUGHRON Assoc. Dip. Electronics

The Ducati Dealer Team 916 Corsa's ECM

This month we look at the Ducati twin cylinder motorcycle, and in particular at its Weber electronic engine management system. At first we look at the racing version, which is out of reach in dollar terms for most of us, and then we check out the road-going version. I might add at this point that both bikes are very quick units and the 916 is a sensational looking motorcycle.

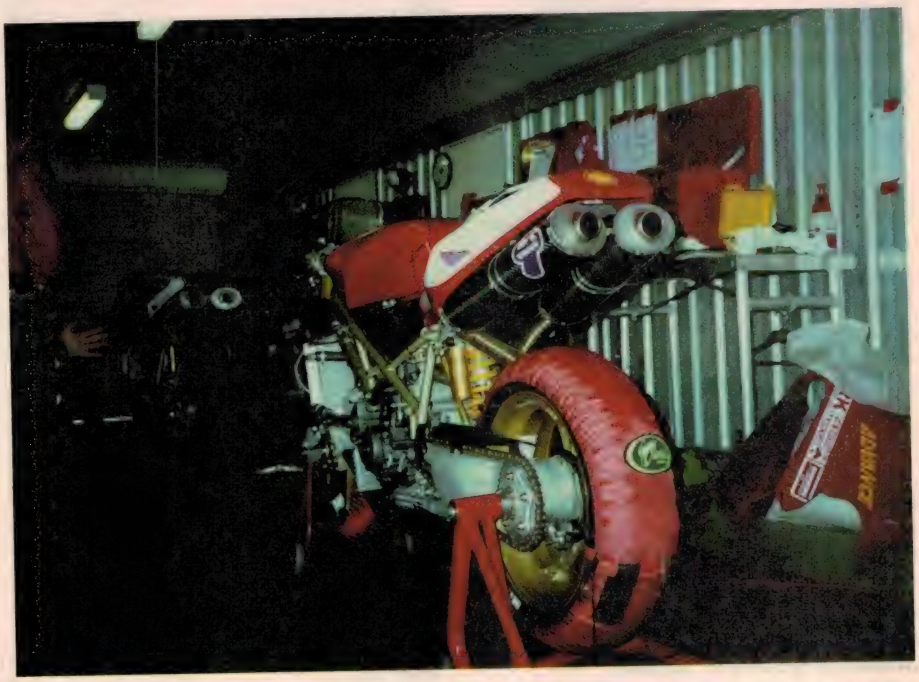
On the long weekend of 6-8th June, I attended the Superbike meeting at Phillip Island and had the opportunity to speak to the 1997 Ducati dealer team manager Arthur Davies about the Ducati 916 Corsa fuel injection system. The system used on the bike is the Weber injection system and it became evident that the bike has very impressive specifications.

The weekend's racing was Round Two of the Shell Advance Australian Road Racing Championship (ARRC) and essentially it consisted of watching a bunch of maniacs going as fast as possible and trying to defy the laws of physics whenever they possibly could. This provided an entire weekend of top class, very fast and entertaining competition, not only in the Superbike class but also in all of the other classes.

From the front photograph of one of the bikes it can be seen that the ECM is mounted on the front forks. The rear view of the bike shows the massive rear tyre with the tyre warmer fitted. These warmers are an absolute necessity in modern racing — they are used so that the optimum operating temperature can be acheived quickly. This ensures that all those ponies can be put down on the track, with absolute confidence.

This racing provides the Mick Doohans (four times 500cc world champion) and Troy Corsers (1996 World Superbike champion) of the future. And after seeing what it takes, I can honestly say that the term 'maniac' that I used above is said with the utmost respect for some very talented and very, very brave individuals.

Apart from watching some very good racing, I also had a chance to discuss the specifications of the Ducati 916 electronic fuel injection system with Arthur Davis and also see the way a professional motorcycle team goes about their business on race day. As I have already mentioned, the technical specifications of this bike are very impressive; Arthur said that the racing Duke was a very trick unit and if I wanted one, he wouldn't give me much change out of $75,000!



Visible in this rear view of the 916 Corsa is the massive rear wheel with its warmer, used to achieve optimum operating temperature before a race.

The bike's technical specifications are shown in Table 1.

Wide throttles

While I was speaking to Arthur he mentioned a few interesting facts about the system. One of these facts sticks out in my mind particularly, and it is that the racing version of the bike has 60mm throttle bodies — one for each cylinder.

The interesting thing about this is that there is a fair amount of air induced by such large throttle bodies, and from previous articles hopefully the reader will appreciate that a lot of fuel has to be provided to match the incoming air; hence the two injectors per cylinder. Installing carburettors of that size on the bike and trying to get them working efficiently would be quite of a challenge!

I spoke to Steve Martin (one of the factory riders) regarding the Ducati 916, and asked him about the difference between a carburettor engine and the fuel injected version. Steve started road racing around 1988 and has won various Victorian and Australian titles, on four cylinder in-line Japanese bikes. He also finished fifth in the '96 Australian Superbike road racing championship and at this meeting he belted around the track, in qualifying at under one minute and 36 seconds.

Apart from being very happy with the handling of the Ducati, he said that the bike had a lot of 'low down grunt' (due to the V twin cylinder configuration) and that the injection system seemed deliver good power across the entire rpm range. He also said the main advantage of the fuel injection system is that the rider did not have to worry about any carburettor jetting changes due to changing atmospheric conditions, because the ECM looked after all of those adjustments.

Steve must have liked the set up, because he set the fastest lap in race one, which also happened to be a new Superbike national record for the Phillip Island track (1:36.149).

But enough of the racing — the road bike specifications are more relevant to most of us. As mentioned above the Weber system controls the fuel injection, but it also has spark control, so it is more of an engine management system than just a fuel injection system.

The road-going bike is very different to the racing version, with a different wiring harness and ECM location. On the race bike this is mounted in between the front forks (where the headlights would be), whereas the road version has it mounted under the seat. The road version also has only one injector per cylinder.

Another difference, which I guess would be obvious by now, is the fact that the road registered version is much less expensive.

ECM connections

The road bike ECM provides the normal inputs that can be found on an engine management system, namely:

- Absolute Pressure Sensor (APS)
- Coolant Temperature Sensor (CTS)
- Throttle Position Sensor (TPS)
- Air Temp Sensor (ATS)
- System trigger (Inductive pulse generator)

Table 1: Specifications

Model:	Ducati 916 Corsa.
Engine Type:	Liquid cooled twin cylinder 'L' 90° double overhead cam, four valves/cylinder, desmodromic valve system.
Bore x Stroke:	996cc - 98 x 60mm.
Power output:	55hp (115kW) at 11,000rpm.
Fuel System:	Weber electronic fuel injection, two injectors per cylinder.
Chassis:	Tubular space frame (motor as stressed element).
Front Suspension:	Ohlins upside down forks with external adjustment for extension, compression and spring preload.
Rear Suspension:	Ohlins shock absorber with adjustment for compression, rebound and spring preload, single sided swing arm.
Brakes:	Front 320mm, double cast iron discs. Brembo pads and callipers. Rear 200mm, single cast iron disc. Brembo pads and callipers.
Wheels:	Marchesini magnesium Front 3.50"/3.75" x 17" Rear 5.75"/6.00" x 17"
Tyres:	Michelin
Minimum Weight:	162 kg

Fig.1: The specification for Ducati's air temperature sensor (ATS)

Temperature	Resistance (Min)	Resistance (Max)
0°C	9.26kΩ	10.23kΩ
20°C	2.85kΩ	3.15kΩ
60°C	0.71kΩ	780Ω
80°C	35Ω	390Ω

Fig.2: The specification for the coolant temperature sensor (CTS)

Temperature	Resistance (Min)	Resistance Max)
0°C	8.73kΩ	11.01kΩ
20°C	3.40kΩ	4.13kΩ
60°C	670Ω	830Ω
80°C	340Ω	420Ω

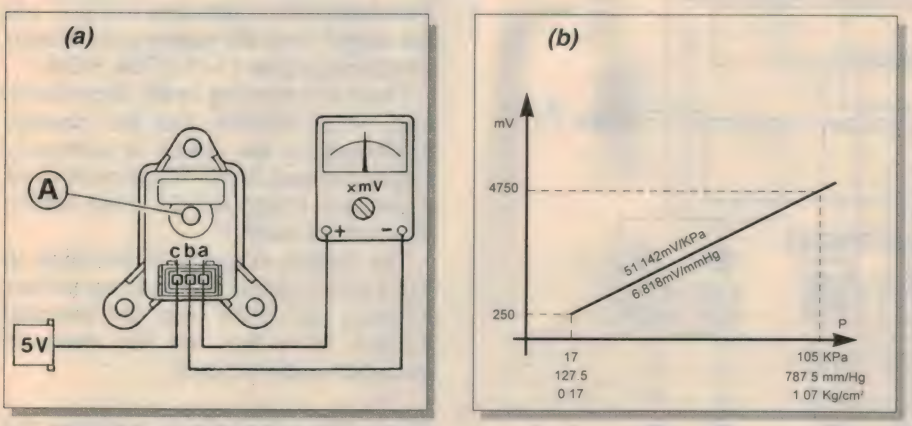
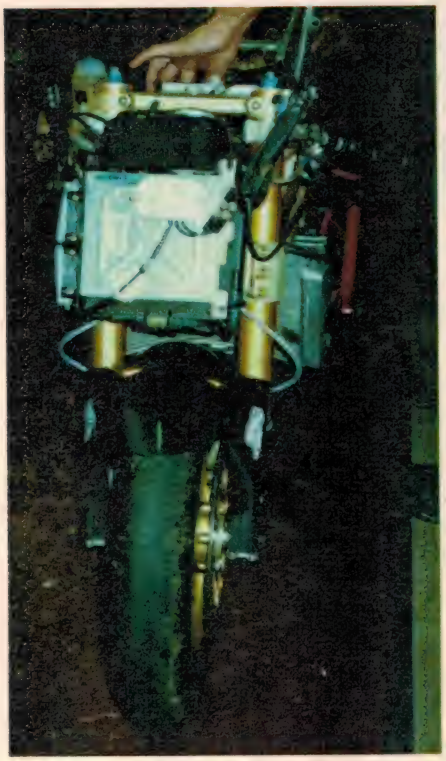


Fig.3: The connections to the APS are shown in (a), while (b) shows a plot of sensor output voltage (V) vs pressure (P).

Note the absence of an oxygen sensor. When data logging is done, to tune the bike at the track, an O2 sensor is mounted in the exhaust system to find any 'holes' in the injection map.

The ECM has output drivers to control two ignition coils, two injectors, (one per cylinder), one fuel pump relay and one control (power supply) relay. The ignition is not driven directly from the ECM, which has ignition modules to switch the heavy primary current.

The ECM has a 35-pin connector that is similar to the Bosch Motronic and L-Jetronic systems and the power supply (+12 volts) is connected to pin numbers 35 and 26; the earths connect to pin numbers 34 and 17.



On the racing 916, the Weber ECM is mounted on the front forks for easy access.

The trigger for the system is connected to the ECM across pin numbers 10 and 11 and the signal is supplied by an inductive pickup that is placed adjacent to a 'trigger plate' rotor on the motor, on the end of the crankshaft. As the trigger plate is rotated it will cause the pickup to generate an AC signal, which enables the ECM to determine the exact location of the crankshaft, and therefore piston location. This ensures the correct ignition advance and injection firing can be accurately timed to provide maximum power.

The resistance of the sensor is approximately 700 ohms and the resistance and output voltage should be checked if a no-start situation exists. I should not have to remind the experienced technician to check the basics first. Fuel pressure, fuel flow and power supply to the ECM and relays must be always be checked before any further tests are performed. Pin 4 on the ECM grounds pin 85 of the EFI relay and pin 23 controls the fuel pump relay.

The TPS is mounted on one of the throttle bodies and naturally they are linked together, so that they open simultaneously. The output voltage of the sensor is connected to pin 30 of the ECM and I did not get a chance to measure the output (the bikes at the track were not still very often, and the TPS specs were not included in the brief that was supplied to me). But I assume, from most other fuel injection systems that the supply voltage to the TPS is 5.0 volts (this also can be seen from the system diagram, showing that the TPS shares the 5V APS supply), and the output voltage would vary from between approximately 0.5V at idle to approximately 4.8 - 5.0V at wide open throttle (WOT).

Negative tempco

The CTS and the ATS both have negative temperature coefficient characteristics. The CTS is connected to pin number 13 and the ATS to pin number 31, and the specifications are given in Figs.1 and 2. The ECM uses these inputs to trim the mixture for optimum performance and as mentioned previously by Steve, the rider does not have to worry about rejetting carbies due to changing atmospheric conditions. The ATS provides information to the ECM and corrections are made automatically by the software. The CTS relates engine temperature back to the ECM so that enrichment can be modified according to engine temperature.

The APS also gives the ECM information about barometric pressure, so that compensation can be achieved by the ECM and a better fuel map can be provided for optimum performance. The supply voltage and output of the sensor versus pressure is provided in Fig.3, and the output from the sensor can be measured across pins 11-15 of the ECM.

There is a warning in the documentation which advises that the ceramic diaphragm in the sensor is extremely fragile and may break if high pressure or depression is applied. So when testing this unit, be careful!

The system diagram is provided in Fig.4 and it shows the interconnections between the ECM and the external devices. Note that the fuel pump is mounted inside the tank.

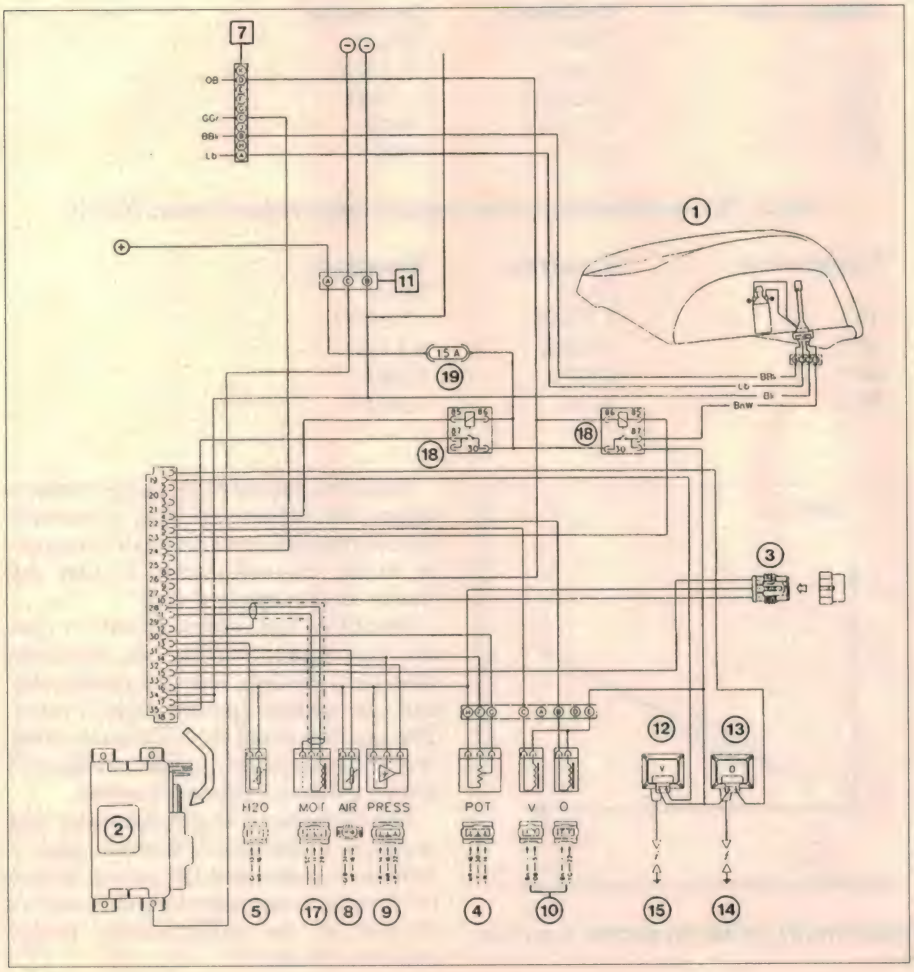


Fig.4: The connections between the Ducati's Weber ECM and the various external devices.

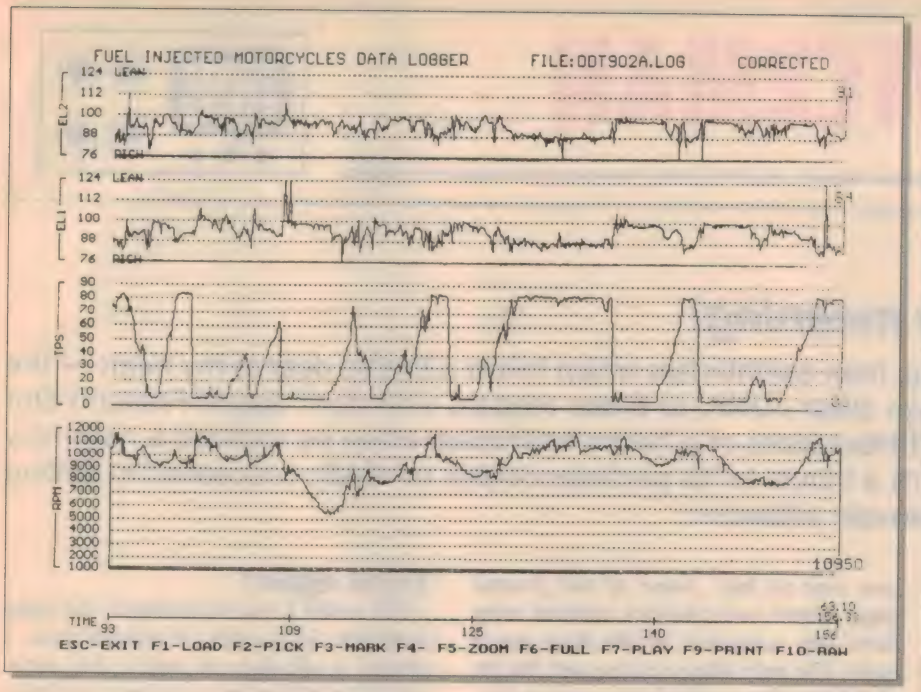


Fig.5: A sample of Fuel Injected Motorcycles data logging.

Data logging

I wrote briefly earlier about data logging for the bike and while I was talking to Team manager Arthur Davis, he said that I should speak to Duane Mitchell. Duane is responsible for the software upgrades and data logging for the Ducati system, and he has made some pretty trick hardware and software tools to interface to this systems. I spoke briefly with him about the system and his company, Fuel Injected Motorcycles.

Duane has some very interesting data about all types of systems, but there is enough information for another article, so I won't be covering it here. He did supply me with some graphs and data from some of his previous work and they can be seen in Fig.5. The graph relates to O_2 sensors mounted in the exhaust, EL1, EL2, TPS and the engine's rpm. From these details he builds a cross reference map so he can target specific points where there might be problems with the system — see Fig.6.

I would like to thank Ducati, Arthur Davis, Duane Mitchell, Shell Australia and Phillip Island Motor Sport for providing the information and facilities for a very interesting and exciting weekend. If you do ride a motorcycle, I strongly suggest you support the Shell Advance Series and go to the Island (or any racetrack) whenever the National series is on, because the racing is absolutely sensational. Until next time, 'bye. ❖

FUEL INJECTED MOTORCYCLES Auto Correction - Front corsa.tgt

81	0	0	0	0	0	0	0	0	-2	0	3	1	1	2	1	1
68	0	0	0	0	0	1	3	6	-2	4	-6	0	-1	-2	-3	0
62	0	0	0	0	0	-4	0	-2	0	0	0	8	1	0	-1	3
56	0	0	0	0	0	5	7	0	-2	1	2	-1	2	-2	-2	0
52	0	0	0	0	0	0	6	3	0	3	3	1	1	1	0	2
46	0	0	0	0	-3	0	2	0	2	-1	1	1	1	-2	-2	0
42	0	0	0	0	0	5	3	4	1	2	1	4	-2	-2	0	0
36	0	0	0	0	-5	-1	6	4	1	2	3	2	1	-3	0	7
30	0	0	0	0	-6	0	-3	1	1	-2	0	-1	2	-2	-7	0
25	0	0	0	-7	-3	0	-3	-1	0	-2	-1	1	1	6	5	0
18	0	0	0	-5	-1	-1	0	-1	-2	-1	0	-1	1	28	3	0
11	0	0	0	-5	-3	-3	0	-1	-1	1	1	0	1	4	3	0
8	0	0	0	-4	-3	-3	-3	-2	-1	-1	-1	0	-1	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	-9	0	0	0	0	0	0	0	0	0	0	0
	10	20	35	50	60	70	75	80	85	90	95	100	105	110	115	120

Fig.6: Using data like that in Fig.5, FIM can produce this kind of cross-reference map to isolate problem areas.

WEBTV

(Continued from page 19)

become a distributor to these consultants. And when those consultants appoint further consultants and themselves become distributors, you move up to the next level and Get Rich Quick.

A copy of the pyramid selling organization's company magazine has come into my possession. Every page is filled with razzle-dazzle. Page 2 features a three-step procedure for hounding your sales prospect into submission. It is not until page 9 that the words 'Rags to Riche$' appear. *I felt my life was destroyed last year when I crashed my car into an eighteen-wheeler... I had to let my business go... I had no income, car, or job. At a swap meet I came across a booth with a gentleman named Don Lane* (surely not THAT Don Lane!) *...I asked for a demonstration of this thing called WebTV... the more I heard, the more I saw this as the greatest business opportunity ever!* And so it goes. If you find you don't like selling WebTV you can try skin care cream instead, through the same company.

The future?

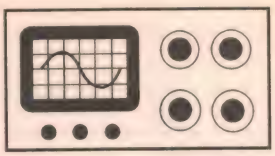
So what's going to become of this WebTV? All in all it seems to be a fine product, and it certainly deserves to succeed. More e-mail, from a happy user: *Tom: We have had WebTV for about six months and feel it is a great value for the money and very easy to use... It is hooked up to a 31-inch TV, which makes surfing from your easy chair a real pleasure. Down sides: no spell check, no games, but upgrades are automatic and no maintenance problems. Obviously someone with your technical background would feel very constrained by the system in its current form...*

And he is absolutely right. I wouldn't be happy with WebTV myself, because I wouldn't be able to fiddle with it, like you can with a computer. But the world is full of people who couldn't care one big hoot about computers, although they'd still like to try the Internet.

It does seem, at least in the USA, that the marketing thrust for WebTV is all wrong. They are trying to attract the TV addict into a whole new TV-like experience. And they are trying to dumb-down the Internet to couch-potato level. Wouldn't it be better to offer WebTV as an alternative to the computer — a simple system that uses a telly as a tool to display information? For thinking people?

(Continued on page 46)

THE SERVICEMAN



'Fixing it in a flash' gained a whole new meaning!

This month we have some stories from contributors which follow a theme dear to my heart — the resurrection of junque (that's high class JUNK, to those readers who don't speak French!) Our first story concerns the trials and tribulations of a hobby enthusiast when he rescued a near-new security light from the local tip. It's a tribute to his persistence that he finally succeeded in getting it going, despite some rather dramatic setbacks...

I've often spoken about finding useful items on the tip, and in recent months several contributors have written along the same lines. It reveals quite a lot about our society, when you see how little work is often needed to restore these discarded items to full working order.

Our first contribitor this month is David Vieritz. His story came via the EA Bulletin Board, and he forgot to add his address. Through the marvels of modern communications, we were able to find out that he comes from Mango Hill, in Queensland. (I hope not too many contributors forget their addresses — I had to go through a lot of telephone books before I found Mr Vieritz's address!)

Mr Vieritz's resurrection job wasn't an easy fix. It took a lot of effort to restore his find. First he had to find out how it worked, then he had to fix it, then he had to fix it again. But I'll let him tell the story:

I have been an voracious reader of 'The Serviceman' for a number of years. It is my favorite page in a great publication. May it continue for years to come...

Some of the Serviceman's letters can be quite amusing as well as informative so, for your entertainment and edification, here is a story of what happened to me recently. Perhaps there's a moral as well.

I helped a neighbour to take a car body to the tip. After dumping the wreck we had a scrounge around in the recycling bin. We were surprised to see a number of new ceiling fans in the bin, some with the plastic wraps still on them. I had no use for those, so I dug further and found a near new and almost intact automatic exterior light.

It was styled after those old coach lamps and would have been an expensive unit to buy. None of the frosted glass panels were broken, neither were there any scratches on the deep green paint. The only thing missing was the little 'spire' that would have gone on top.

I thought that this was quite a find, as an automatic exterior light would be useful and the colour exactly matched the colour scheme of my home. So why was it thrown out?

There were marks on its mounting points which suggested that it had been installed somewhere. And the fact that it was with the new fans led me to conclude that a shop had disposed of a collection of faulty products that were judged not worth fixing.

Which therefore meant that there HAD to be something wrong with the light. But what could it be? And could I possibly fix it, I wondered...

The light has one of those movement detectors: a 'PIR' module which runs directly off the mains. Then there would have to be something that switched the power to the light, and this would cop the most abuse. So I figured there would be a faulty relay or some type of switching semiconductor that would need replacing. Then I'd have a nice looking lamp for nix — or so I thought!

I got it home and onto the bench and found that the PIR module was in a sealed box. Since there had to be a fault in the PIR module, I cut the back off the box and prized out the circuit board.

There was nothing obvious; no charred remains, etc., but there was a very small Triac (a BT134) in one corner. "I'll bet that's blown", I thought. So to prove the point I wired up a mains lead to the board and a lamp and flicked on the switch. Immediatly the lamp lit and I watched it in smug satisfaction that I had found the problem; a shorted triac!

Think again!

But while I was watching it the lamp went out. So it wasn't a shorted triac. I turned it off then on again. The lamp would light then go out after a few minutes. I then realized that the problem was not to be as straightforward as I had hoped.

There followed many, MANY hours spent fiddling with the circuit, trying to understand how it worked. Since I am only a hobbyist in electronics, you can imagine the difficulties I had. So I shall spare you the tedium of relating all the blind alleys I went up and just tell what I discovered.

I found that the PIR was too sensitive to movement. The module has two sensors: a movement sensor and a light sensor. Both sensors provide a varying voltage to a quad op-amp IC which determines when to switch on the lamp.

The IC detects movement day or night, but can only switch on the lamp when the ambient light is low enough as the LDR sensor overrides the movement sensor. The module always switches the lamp on when first powered up, but after a few minutes the lamp would go out and stay out if the LDR detected sufficient light (as it would in the day time). However in darkness the lamp would stay on permanently.

The Triac is driven by two Darlington-connected transistors. The transistors' base current came from an IC via a capacitor that has a bleed resistor across it. When the IC detects movement it charges the capacitor, which then turns on the the transistors — which fires the Triac and lights the lamp.

When movement ceases, the IC's output goes low and the capacitor slowly discharges through the resistor until the voltage reaches a point where the

transistors turn off, which turns off the triac and the lamp.

The lamp's ON to OFF timeout period is set by the value of the capacitor and its bleed resistor. The problem was that the IC was constantly detecting movement, even when nothing moved! So the capacitor's charge was constantly 'topped up' and the lamp would remain lit.

And that was the nature of the problem. Constant triggering. I tried wrapping the circuit in a blanket and placing it under my bench where it was dark and quiet and then it did switch off. But I only had to touch the bundle to trigger it on again. It was that sensitive.

So I had to work out why it was so touchy. Again I'll spare you the dreary, hour-dragging details but simply, the IC amplified the signal from the PIR detector through one op-amp into another where it was used as a differential amplifier.

(I did spend a long time fiddling with the PIR detector itself, and concluded it was not faulty. I have no idea how it works but it seems to change resistance with movement. Amazing!) The signal was constantly fluctuating. Not in what might be called a 'noisy' way, but just randomly bouncing up and down.

The op-amp had two signals feeding into it; the original jerky one and a slower moving version of the first. Aaha! I thought — a comparator! If I try to make the signals have less of a difference between them, then it won't be so sensitive. But try as I might, by changing resistor values to reduce signal levels or differences, I'd either make it worse or it would not work at all.

I was running out of ideas and getting a bit fed up too. So I fiddled around with the values of a couple of electrolytics that seemed involved with the signal path. One was a 47uF associated with the IC and the other, right alongside, was a 0.47uF which was across the PIR detector.

I first tried changing the 47uF to 100uF to see what would happen. Murphy saw to it that I had chosen the wrong direction. So I reduced the value to 1uF (I had nothing else to lose). Blow me down — it made an improvement!

The lamp would still trigger, but nowhere near as often as before. I noticed that the second (slower) signal now tracked more closely to the rise and fall of the first signal. Hmmm... Interesting! I then turned my attention to the 0.47uF across the detector. I wondered if a higher capacitance would slow down the jitter. So I changed it for the 47uF that I'd just pulled out.

Guess what?! No more false triggering! I set it up outside (it was then night) and found that it would not light up until I had walked right up to it and passed my hand over the sensor. So now it was not sensitive enough.

Solved in a flash

No problem. I decided to try a 2.2uF cap across the PIR detector. But before setting it up outside again for a test I hooked up the CRO to check the PIR signal after the change. I plugged in the circuit and switched on. What followed was a brilliant flash, accompanied by an enormous 'WHACK!' and followed by darkness and silence...

Up to this point I had been powering the PIR circuit through an isolating transformer, so I could attach the CRO without causing any problems. This time, in my haste and jubilation of finally getting somewhere, I had plugged the PIR straight into a power point.

With the CRO attached (the earth lead onto the PIR's 'negative' rail), I had effectively earthed out the Active with the little PIR circuit board the meat in the sandwich.

The flash was caused by several tracks vapourising. The 'whack' was the triac disintegrating. The darkness was the result of the Earth Leakage Unit cutting off the power to everything (I thank God it's there), and the silence was the numbness of my brain sitting there in the dark, slowly realizing what I had done.

Naturally, once my thinking processes started to thaw, all I said to myself was "Deary me" and "You old silly" as I groped about for the ELU switch. With the lights back on, I surveyed the disaster.

A lot of the tracks were missing and there was even less of the Triac. And goodness knows what else had been blasted to Silicon Heaven. In other words, a real mess. In my disgust with myself I picked up the whole thing and dumped it in the bin.

I know it had not cost me a cent, only the time spent on it. But what got to me was the fact that I had it working! So that is how my day finished at that time. But that is not the end of the story just yet.

The next day I retrieved it from the bin and had another look at it (saw it in a new light, you might say). I decided that this little hiccup was not going to beat me. So with a set jaw and a grim smoldering iron, I methodically removed and checked the components on the circuit board.

Starting with the diodes, only three had survived out of about a dozen. Two transistors out of six were OK; an electrolytic capacitor was very leaky (about two megohms); but the rest of the components seemed alright, even a

tantalum capacitor was unharmed, though these things tend to kark it if you look sideways at them.

The IC was obviously dead. No IC could possibly survive having a few of its legs 'mirrored' onto the surrounding circuit board. But the resistors checked out fine. No duds. The sensors seemed untouched too.

Once all components had been checked and a list made (it looked like a KIA Honour Roll), I gathered all the parts I needed from my junk boxes, except for the IC and a 4V zener. I had to buy those — set me back all of two dollars!

I carefully repaired the missing tracks with bits of bell wire. The Triac, a BT134, I replaced with a BT137 that I had on hand. But I found its tag too long to allow the circuit board to fit back into its box, so I removed most of the tag with a hacksaw!

I fitted all the parts minus the IC, and scrubbed up the board with a toothbrush and metho. Then washed the whole lot in soapy water. It came up like new (almost). After letting it dry, I wired it up to the mains and applied power (still without the IC). No flash, no bang, no smoke — good!

I checked voltages around the IC's pads and found nothing suspicious. Fitted the IC and switched back on. Guess what? It worked! I set it up outside and found that I could walk to within about three metres before it would switch on. Which was just what I had been hoping for!

Which meant that I'd had the bugs ironed out when I was about to give it the final test. And I then had to go and blow it up, didn't I? Ah well, it's working now, so there is a happy ending.

Conclusions? I'd say the wrong value capacitors were used, a fault that had existed from new. There were 47uF and a 0.47uF electros side by side. I'll speculate that these had been transposed during assembly. But who really knows?

Regarding myself, I should certainly have remembered to use the isolating transformer. I loath working on stuff that is powered directly from the mains, SMPS and the like. I have been booted by 240V often enough to appreciate how lethal it can be.

Well! How about that?

I suspect that very few readers will have known how one of those security lights worked, and probably, like me, have never been asked to fix one. They seem to be a fairly reliable product, but there must be occasional failures. When that happens I guess most of them end up on the tip.

Of course, a professional serviceman could hardly afford to spend the time studying the operation of something usually considered disposable. It takes an amateur with time to spare to do that. But now, thanks to David Vieritz, we have a good idea how the thing works and what we are likely to find inside it if we're ever asked to 'have a go!'

What is surprising about this story though is the failure of a supposedly new unit. I feel that the quality control by that manufacturer must have been of the lowest order. On the other hand, it did provide the subject for an interesting story, for which we should be thankful.

And I won't say a word about mains supplies and live chassis and isolating transformers and workshop safety. The paragraphs above say all that is needed on the subject. Thanks again, David!

Cleanup rescues

Now we come to our second contributor for this month. He is Bert Toomey, of Bucklands Beach in New Zealand. Like our previous contributor (and the present scribe) he is unable to resist the lure of junque.

Bert calls his story 'Two from Junk — plus One' and he relates how two worthwhile finds finished up working as well as they ever did. (The 'Plus One' is all that prevents this month's column from being a total 'Hymn to Junque')

Here's what Bert has to say:

It was the first day of our local inorganic refuse collection. The dog and I were heading home hoping to beat an imminent shower.

At the side of the road was a cardboard box containing an unmarked Hitachi D-E25 tape deck. My conscience wouldn't let me leave it there, so I carried it home.

My first inspection revealed a unit in pristine condition. Taped to the cover was a 25mm length of flat spring steel. I didn't attach much importance to this at first, but soon realised it had broken off from way down inside the transport mechanism.

I put a tape in the machine and pressed the part originally held down by the spring. Music poured forth from the headphones. It would be a mammoth job to replace the spring; even assuming I could get one and with labour charges being what they are, I could see why the recorder had been dumped.

The part held down by the spring worked in a plastic 'slide' and stuck out above it. To the right was a cylindrical part of the plastic moulding. I could see no reason why the part could not be held down by pressure applied elsewhere, so a spring from a discarded set of ignition points was heated, partially straightened and left to cool.

A hole for a 2mm screw was drilled in the spring using a sharp drill and a slow speed. Attaching the spring and getting it into the right position wasn't all that easy, but eventually I prevailed. The pressure is now imparted onto the wrong part of the plastic cylinder, but the recorder seems to be working as good as ever and was well worth the 35 minutes it took to fix.

Kambrook CTV

Again, I was walking the dog and there in the 'collection' was a Kambrook CBS4316 14" colour TV. I hadn't seen it the previous day and as it looked to be 'all there', so I decided to return with the car and uplift it.

The only obvious fault was that the mains off/on switch had been wedged 'on' with some bits of matchstick. Inside, it didn't appear to have been 'got at', but some rain had dripped onto the main board. I put a 60 watt lamp inside, covered the set with a towel and left it to dry for a week.

No one could have been more surprised than I, when at switch on, up

came the picture and sound. The brilliance and contrast controls had plenty of adjustment, indicating the tube still had some life left.

I tried setting the tuner to one of the UHF channels, but with poor results; so I decided take the set indoors to try on the main aerial. At switch-on I thought I heard a slight click, but this time I had sound but no picture.

A week later a friend called and as he was leaving he asked how the TV was going. I told him the sad story and demonstrated by switching the set on. Yes, you've guessed it, up came the sound and picture.

Now I was beginning to realise why the set had been put out. At first, I thought there must be some fault with the external video/audio input board. The antenna also plugged into this board and this was the only thing I had touched.

Inspection with a magnifying glass revealed some definite dry joints. These were resoldered and again I had sound and picture. The set was run for four hours and it went 'like a bought one', as the saying goes. I left the back off for the time being as I intended to fit a new mains switch.

Some days later the set was switched on, only to greet me with sound but no picture. I was getting the message by now. At the next switch on, sound and picture were present but after a few seconds, the picture disappeared.

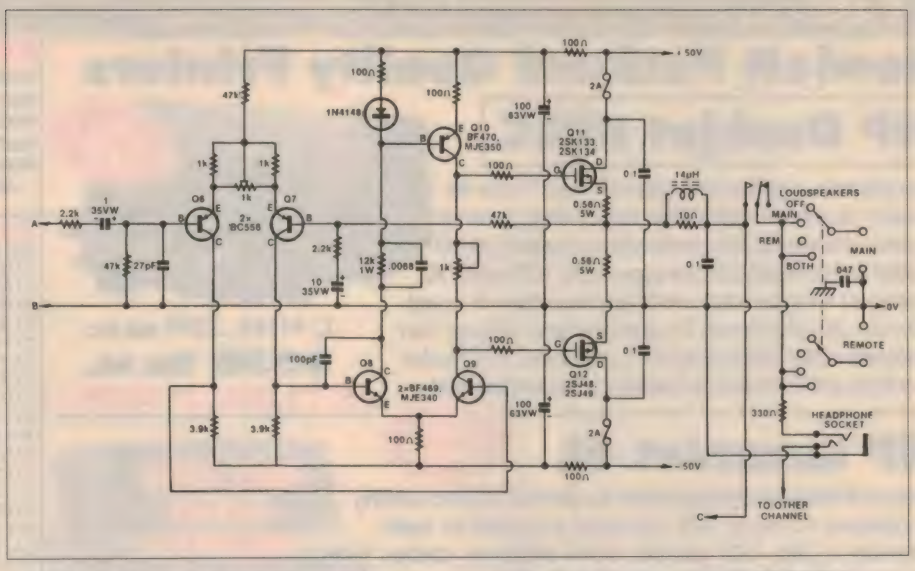
In sheer frustration I gave the set a thump on the top of the cabinet and the picture returned. The only thing that was rigidly fixed to the case was the picture tube and as far as I could see the only possibility for a loose connection was at the EHT cap.

I gave the cable a few twists at the EHT plug, which restored the picture and it's performed faultlessly ever since. The flat that the set came from quite was close to a beach. Possibly the salt air had caused some corrosion on the plug and the twisting had removed it.

His own Playmaster

Bert Toomey's final tale is the only one that doesn't include a junked piece of equipment:

The 'plus one' part of this story concerns my own Playmaster MOSFET Stereo Amplifier. (EA Jan 1981). I've had many hours of listening pleasure from this unit and it's a great tribute to its designer. But lately the amplifier has been intermittently distorting on one channel. At first it seemed the bass control was the culprit, as rapid turning back and forth would restore things to normal. Eventually, the distortion



The circuit for the power amplifier sections in the Playmaster MOSFET Stereo Amplifier of January 1981. After providing many years of listening pleasure, reader Bert Toomey's unit suddenly began distorting in one channel...

became permanent.

An initial voltage check had shown some slight differences around the collectors of Q9 and Q10. The construction article carries the advice to disconnect the inputs at pins 35 and 37 before working on the power amps.

I had intended to do this once I'd checked as far as Q5, but a hurried switch off became necessary when I connected a scope to the base of Q4. Wisps of smoke curled up from the 10-ohm resistor in parallel with the output chokes.

I later found one of the 2A fuses had blown. I replaced this and was stunned to find the output waveforms on both channels to be fine. I set the quiescent current as described in the article and the amp was performing as well as ever.

The trimpots in the collectors of Q9 and Q10 were very 'touchy' to adjust and I came to the conclusion that one of these must have lost contact with its track. I'd like to replace them with a 10-turn variety, but it would be a lot of work to remove the board. Perhaps there's a case for having a removable base on the bottom of the cabinet.

So there you are! I know that particular model of Hitachi cassette deck mentioned at the top of Bert's story and I would have said it was well worth repairing. I appreciate that Bert might have found the mechanism rather complicated, but it should not have cost an unreasonable amount to have it repaired properly. Obviously, someone just didn't want it and threw it out.

Similarly, the early stages of salt air corrosion is hardly sufficient excuse to discard an otherwise serviceable television. I suspect that our present society just has too much money for its own good. It's easier to buy a new one than it is to find someone to repair the old!

Finally, I agree with Bert that removeable bottom panels would make work a lot easier. Most VCRs are so fitted, but then they are relatively expensive items and can bear the cost of the extra panel. Amplifiers, particularly kit sets such as the Playmaster, have to be made down to a price and the additional costs would be hard to justify, particularly for a feature that has no bearing on the performance of the amplifier.

That will have to do for this month. I don't know what next month will bring, but you can be sure it will be interesting. ❖

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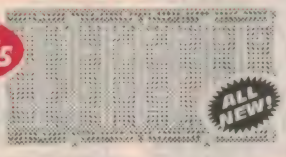

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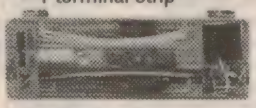

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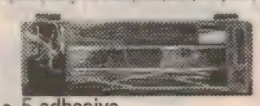

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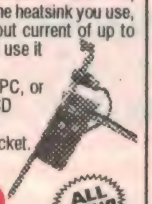
EA Aug'97



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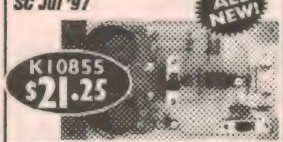

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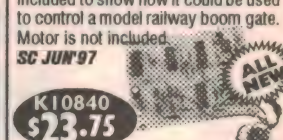

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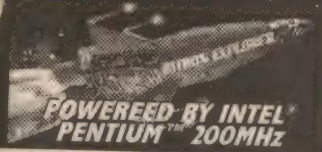

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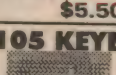

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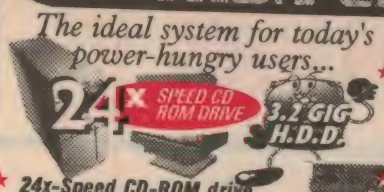

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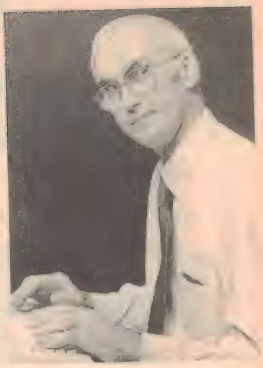

The EMC Framework, double adaptors and the health aspects of handheld cellphones

I have a particularly mixed bag for you this month, with comments from readers concerning a number of the topics we've looked at recently. The question of cellphone-user health risks certainly hasn't gone away, of course, but some of the other topics have obviously been keeping people thinking as well. There's also a bit more information about the Microshield, that British shielding device claimed to reduce the component of radiation from handheld cellphones which passes through the user's head.

To start the ball rolling, I have a message which arrived by e-mail in response to the piece on the new EMC Framework regulations I ran in the August column, from a reader who asked to be identified as 'Mr Fixit'. You may recall that the reader in question was a small local electronics manufacturer, and was very concerned that the EMC Framework regulations were likely to stifle firms like his, by increasing the costs of developing new products to a prohibitive and unreasonable level.

The response to Mr Fixit's letter came from Sydney design engineer Peter Baxter, who has contributed some microcontroller-based project designs to *EA* in the past. Peter works as a designer in another electronics company, but seems to be writing on his own behalf rather than representing his employer. He takes a rather more positive approach than Mr Fixit, as you'll see:

Unlike most EA readers, I do have basic EMC test equipment including spectrum analysers, antennas, a shielded room, CISPR standards. I have also put a lot of effort into becoming educated on EMC issues by going to seminars, joining EMC Network groups and doing a lot of reading.

There has been a lot of promotion of EMC over the last few years, which many people have taken advantage of (and much of it has been free). I've also attended seminars where they let you bring along your gear to test on their equipment. And yes, I've failed!

But theory is one thing. We're all practical people who build things. My weakness the first time around (and others), was thinking that my product would meet limits. Even though I'd put a lot of effort into designing what I though were good EMC products, they failed. Sometimes, I wasn't even in the ballpark.

A switchmode power supply I designed failed conducted emissions out of the power supply mains cable. After much heartache and frustration, $5 worth of parts from Farnell, relating to mains filtering, enabled me to pass. I won't have that problem again, because I now understand what to do!

The point is this: You have to go through that first hard lesson sooner or later to grasp what it's all about. And it probably will cost a few thousand dollars to do it. But once the PRACTICAL lessons have been learnt, you should be able to apply the knowledge to designing products that pass. You will also be able to create Technical Construction Files with more confidence, as you have previous experience to back it. It is an educational investment in yourself!

Document your EMC failures as much as your passes. It is evidence that you are trying to do the right thing, and it is history of your product development. You learn more from failures than passes. And you will get there. The SMA is out to get those who are ignoring it.

There is still more that needs to be done for the 'backyard' designers (I'm one, you probably are too). I don't know of anyone who has created a designers' EMC lab where you can come and go (at hundreds not thousands of dollars a day) and see roughly whether your design is close. Not a final test lab, but a 'ballpark' lab. Now there is an opportunity. EMC isn't going away!

In conclusion, we all have to take that big EMC step and for many, it's going to be very frustrating. Do it and you'll become a better designer.

Thanks for those comments, Peter. It's interesting to get such a positive response, from someone who seems to have made the effort to come to grips with the EMC Framework and at a small-company level. I'm sure you're right that it isn't going away, and also that those who do make the effort to come to grips with it will end up better designers. However like Mr Fixit, I guess I'm still worried about the impact on Australia's small electronics manufacturers, who really don't need any more financial or bureaucratic hurdles — they seem to have more than enough already!

Double adaptor safety

Changing the subject, you may recall that in the April column I included a letter from Jim McCloy of Muswellbrook, taking to task both our Vintage Radio columnist Roger Johnson and myself, for comments made in Roger's December 1996 column about elderly double adaptors and their potential to cause an electric shock. Mr McCloy didn't like the way the story was presented, and made an assertion to the effect that *Discussions with suppliers or electrical components suggest that Australian double adaptors have never been anything but safe in the past.*

I must confess that this assertion, suggesting that the adaptors with transposed active and neutral connections for one outlet had never been sold in Australia, didn't agree with my own recollections — although I decided to let the matter drop at the time. However it certainly seems to have attracted the attention of long-time reader and very experienced engineer Alan Fowler, of North Balywn in Victoria. Alan is very experienced in

this area, having served on numerous standards committees, and clearly his memory is also somewhat better than mine. Here's what he had to say, in response to Jim McCloy's assertion:

Perhaps Mr McCloy didn't dig back far enough before he said 'Australian double adaptors have never been anything but safe in the past' (Forum, April 1997). The type described by Roger Johnson (Vintage Radio, December 1996), where the active and neutral were reversed on one half of the adaptor, were in common use in the 1940s.

I first struck the problem on a visit to my doctor. He asked if I could explain why his 'examination lamp' wouldn't work properly since a new power cord had been fitted by a local electrical repair shop. The lamp had a heavy base supporting a chrome-plated rigid metal tube with a flexible section carrying the socket, globe and shade mounted on top.

The lamp was normally plugged into one of the above double adaptors, which in turn was plugged into a power point mounted under a stainless steel sink in his consulting room. The lamp worked when plugged into the lower half of the adaptor, but not if plugged into the upper half. In the latter case the power fuse would blow if the lamp touched the sink.

The plug was one of the old open types shown in Roger's article and it was easy to see that it had been wired correctly. I had no tools with me and could only assume that the neutral and earth had been swapped at the connection block inside the lamp base. The doctor agreed to put it to one side and not use again until he had taken it back to the repair shop.

This type of double adaptor was legal back then. Although the earth pin had been defined, there was no agreement as to which of the other two was the active. Where a power point consisted of a separate switch and three-pin socket, there was a 50/50 chance that the active would be the present left-hand pin. If I remember correctly when combination switched sockets were introduced, at least one manufacturer had the active pin on the right.

As a further complication, at least until the 60s, and possibly later, it was not compulsory to have an earth wire connected to the socket unless it was mounted in an earthed situation — i.e., a kitchen, laundry, bathroom, etc.

It comes down to this. If you buy a second hand (used, pre-loved, etc) house and there are any older style switches, power points, fuses, etc, then get the whole installation checked by someone who knows what they are doing.

Thanks for those comments, Alan. I'm not sure exactly when those old double adaptors became illegal, but from memory they were still in use in the 1950s and 60s. I can also remember the confusion about power outlet wiring, so your closing comments about the need for checking the wiring in older homes is very relevant, I believe.

By the way Alan Fowler's letter included some other stories on the subject of electrical safety, which I'll try to include in a future column.

Simple solution?

Now let's return yet again to the topic of handheld cellphones and their possible health risks. I've had a letter from a long-time reader in Doncaster East, Victoria, who believes he has come up with a simple way to make the units safer. The reader is Mr Eris Tilley, and here's what he has to say:

I hope I am not too late to add a logical observation to the mobile telephone brain tissue irradiation debate. Maybe this is too simple.

All handheld units I have seen are manufactured with the antenna at the top, which places the source of radia-

WEB TV...

(Continued from page 35)

Whoever the target is, the sales push is certainly on. Just last night, on a national talkback radio program, I heard an ad for WebTV — phone an 800 number with your credit card ready. They were offering the set-top box for US$249, $50 below retail. The pyramid sellers seem to have matched this offer.

But wait! There's more! The radio ad throws in two free months of WebTV access, worth nearly US$40, AND the infrared keyboard worth $89.85. Is that an offer too good to refuse, or what?

When will WebTV come to Australia, you ask? Well, it might have been fairly soon. During my dealings with WebTV, it was suggested that Tom Moffat might make a good Australian distributor for WebTV. But later, in the company magazine, I found the fine print — when the Phillipines deal was done, US$2 million was mentioned. And for Indonesia and Malaysia, $4 million.

Now my bank account isn't quite that healthy at the moment, so I had to let the opportunity pass. But Australia is bound to get WebTV sooner or later. And *someone* could become very, very rich, or richer. Couldn't they? ❖

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FORUM

tion neatly behind the ear. A reasonable estimate of the distance to the nearest portion of the brain would therefore be about 12mm. If the devices were built with the antenna at the bottom, the 'antenna to brain tissue' distance would be at least 120mm — an increase of 10 times.

Now we all know that radiation intensity varies as the square of the distance, so the intensity of brain tissue irradiation would be reduced by a factor of 100 or more!

Making this change would require some re-tooling, but once done there would be no increase in unit cost.

It seems that there is a psychological concept that antennas should be 'on top'. After all one does not see many television antennas installed in the basement, or taxi antennas under the car! However, the mobile phone is a different case entirely.

As a regular reader since 1955, please accept my best wishes to all at EA. Keep up the good work.

Thanks for that constructive suggestion, Mr Tilley, and also for the kind words about the magazine.

As you say, relocating the antenna to the bottom of the cellphone case would certainly reduce the level of brain radiation to a very significant degree, and no doubt reduce accordingly whatever risk there may be of contracting brain cancer. Judging from the number of users who still seem to be able to use these phones quite satisfactorily with the antenna jammed down inside the case, I'm sure you're also right that swinging the antenna to the bottom of the case would have very little effect on normal operation.

So you may well have come up with a very sensible and practical suggestion, Mr Tilley — although I suppose there's always a risk that cellphone users would then be more prone to contracting cancer of the lower jaw, throat or vocal cords, instead of the brain...

The Microshield

By the way, following our mention of the cellphone shielding device known as the Microshield, some months ago, I've had a number of letters and other messages from readers wanting to know more about the British firm who makes them and how they can be contacted. I had no contact details to pass on until recently, but I have now learned that they can (or could) be found on the Web at this URL:

http://www.microshield.co.uk

I gather that the shield device made by Microshield consists of a cover incorporating a shield mesh of woven polyester and fine nickel wire, and is claimed to block around 90% of the emissions normally likely to pass through the head, from the body of the phone. There's apparently also some kind of antenna guard, but presumably this doesn't incorporate shielding or it would affect phone operation.

From an e-mail I received from a discussion group concerned with EMF-related health risks, I understand that cellular phone maker Motorola may be planning legal action against Microshield, regarding claims made in one of the company's marketing brochures about the health risks associated with using cellular phones.

According to the e-mail, the Australian Mobile Telecommunications Association (AMTA) has written to the Australian Competition and Consumer Commission (ACCC), demanding withdrawal of the brochure concerned. However it would appear that the ACCC may be preparing to test the claims made by Microshield, using 'independent investigators'.

It should be interesting to see what happens, shouldn't it? ❖

"I followed the instructions to the letter..."

One of the other 'anecdotes from the past' about electrical safety sent to us by Alan Fowler concerns the mother of one of Alan's friends, who asked if he could tell her what was wrong with her living room light. She was a very capable lady who was used to doing odd jobs around the house, but hadn't tackled electrical repairs previously.

She went to a local electrical shop, bought a new bayonet cap cord socket and asked the assistant how to fit it. She told Alan that she had followed the instructions exactly, but when she turned the power back on and turned on the light, it blew the fuse each time she tried.

She had been told to turn off the power at the switchboard, cut off the old brass BC socket with a pair of scissors, dismantle the new socket and thread the cap over the wire, strip about an inch of insulation from each of the two wires, put half into each terminal, screw them up tight and screw the socket together etc.

She had done exactly that. She stripped the two wires, counted the number of strands in each wire, took half the strands from one wire and twisted these together with half the strands from the other wire, put these into one terminal; then did the same with the remaining strands from each wire and put them into the other terminal...

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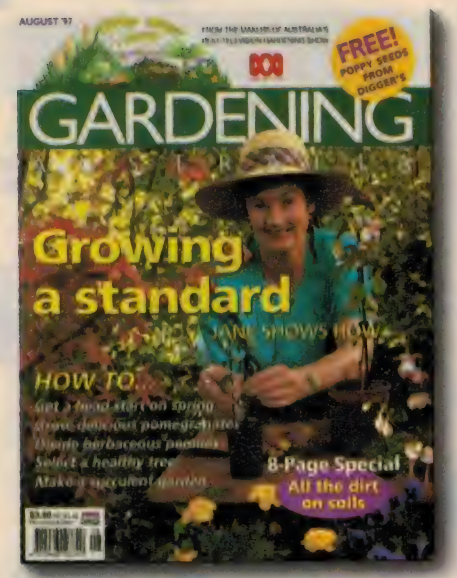

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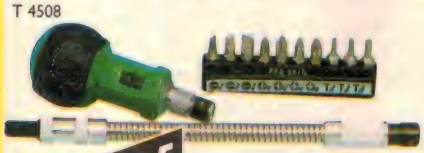

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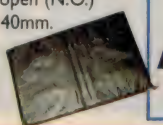

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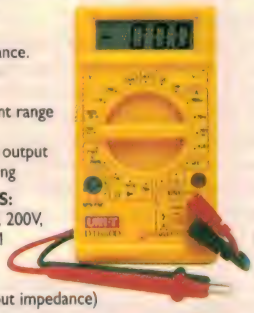

- Measures AC/DC voltages, DC current and resistance.
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- 10 Amp DC current range
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SPECIFICATIONS:
DC V: 0.2V, 2V, 20V, 200V, 1000V (+/- 0.5%, 1M input impedance)
AC V: 200V, 750V (+/- 1.2%, 0.45M input impedance)
DC A: 2mA, 20mA, 200mA, 10A (+/- 1%)
Resistance: 200, 2K, 20K, 200K, 2M ohms (+/- 0.8%)

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3.5 Digit 32 Range Multimeter

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RANGES:
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AC V: 0.2, 2, 20, 200, 750V
DC A: 20uA, 200uA, 2mA, 20mA, 200mA, 2A, 20A
AC A: 20uA, 200uA, 2mA, 20mA, 200mA, 2A, 20A
Resistance: 200, 2K, 20K, 200K, 2M, 20M ohms

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AC V: 200mV, 2, 20, 200, 750V
DC A: 200uA, 2mA, 20mA, 200mA, 10A
AC A: 200uA, 2mA, 20mA, 200mA, 10A
Resistance: 200, 2K, 20K, 200K, 2M, 20M, 200M ohms
Capacitance: 2nF, 20nF, 200nF, 2uF, 20uF

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- Diode Test
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AC V: 2, 20, 200, 700V
DC A: 2mA, 20mA, 200mA, 20A
AC A: 200mA, 20A
Resistance: 200, 2K, 20K, 200K, 2M, 20M, 200M ohms
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AC V: 2, 20, 200, 600V
DC A: 200uA, 2mA, 20mA, 200mA, 10A
AC A: 200uA, 2mA, 20mA, 200mA, 10A
Resistance: 200, 2K, 20K, 200K, 2M, 20M ohms

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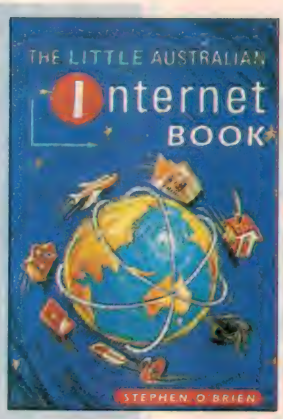

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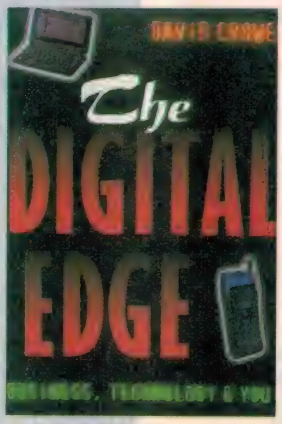

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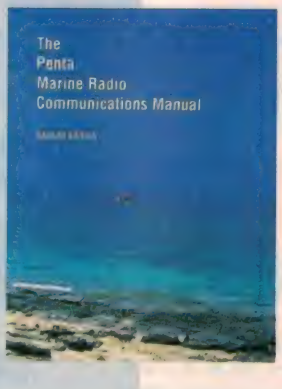

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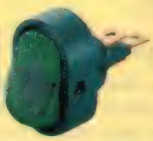

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An incredibly handy tool to have clipped to your belt. It unfolds into strong pliers plus it has a range of fold out attachments such as a knife, screwdriver, bottle opener and file. Supplied with a leather storage case.

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Cuts and strips cables and crimps various 6 pin and 8 pin modular connectors including 6P4C (RJ-11), and 8P (RJ-45) varieties. Rugged metal construction for accurate crimps.

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Professional butane powered soldering iron with inbuilt fuel filter. Comes with a range of iron-plated tips in a storage case. Up to 2 hours operating time.

T 1398

$149

Weller/portasol

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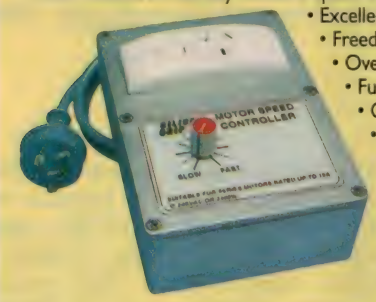
Speed Controller

- Use with routers, jigsaws, grinders, circular saws, electric whipper snippers, fans etc
- Control available from fully stopped to maximum speed
- Uses modern switch mode power supply techniques not traditional phase control methods
- Can power up to 2400W series motor appliances
- Rating of up to 10A @ 240V
- Motor maintains relatively constant speed under load
- Excellent very low speed operation
- Freedom from cogging (irregular bursts of speed)
- Overcurrent limiting
- Fuse protection
- Constructed in safe, earthed diecast case
- Interference suppression included
- Adjustable speed regulation
- Power source required: 240V AC
- Supplied with all components, PCB, pre-punched diecast case and screened front panel

$149 NEW RELEASE



K 3087 SILICON CHIP Nov '97

Video Enhancer & Stabiliser

- Improves image quality from poor-quality videotapes
- Reduces image degradation when making copies of your own family video recordings by allowing a judicious amount of high frequency boosting
- Includes circuitry which offers more stable viewing of video signals by stripping out 'piggyback' information like vertical-interval test signals, teletext data and copy protection schemes
- Enhancement circuitry allows fully adjustable boosting between zero and approx 8dB at any of the three selectable frequencies
- Power source required: 240V AC
- Supplied with all components, PCB, mounting screws, 120mm square of 1mm aluminium sheet for mounting/shield plate, plastic instrument case and pre-punched and screened front panel.

$89 NEW RELEASE

K 5411 EA Nov '97

Active Shortwave Antenna

- Compact and easy-to-construct
- Covers 49 to 13 metre shortwave bands
- Incorporates a tuned circuit for improved selectivity and image rejection
- Power source required: 9 volt battery
- Supplied with components, hardware including telescopic antenna, PCB, case and pre-punched and screened front panel

$39.50

K 6104 EA Oct '97

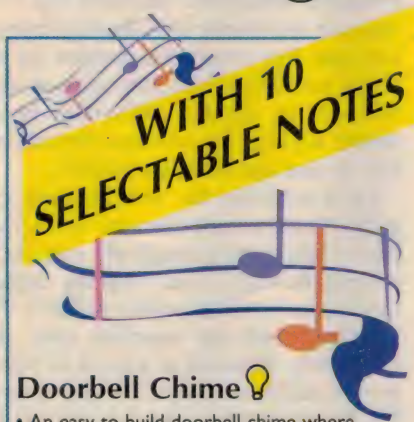
Mini Strobe Kit

For use as an rpm indicator for electric motors, car engines, electric mixers, or anything that moves or rotates. With adjustable range (400 to 4000 rpm) and output pulse to prevent blurring at higher speeds, and bright white 600mcd LED. Requires 9 volt battery. Supplied with components, hardware, PCB, case and front panel label.
PCB size: 60mm x 25mm

$23.50

K 3160 EA Aug '97

WITH 10 SELECTABLE NOTES



Doorbell Chime

- An easy to build doorbell chime where you can program your own tune with 10 selectable notes.
- Compact design
- Install in your existing doorbell housing
- Power source required: 12V DC
- Supplied with components, PCB and mounting screws

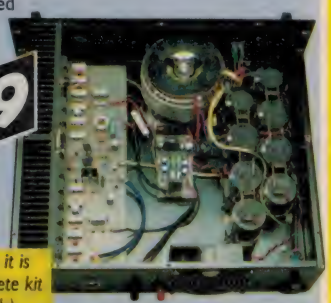
$16.95

K 3803 EA Nov '97 NEW RELEASE

Monster 500W Mono Block Power Amplifier

- Ideal for musical instruments and PA work. Use 2 for a stereo set-up
- Output: 500W RMS @ 4 ohms (278W @ 8 ohms) • Music Power: 590W into 4 ohms (315W into 8 ohms)
- Frequency Response: 0.3dB @ 20Hz & 20kHz • Input sensitivity: 1.43V RMS (for full power into 8 ohms)
- Harmonic distortion: typically less than .01%
- Signal-to-noise ratio:117dB unweighted (20Hz - 20kHz); 122dB A-weighted
- Thermal cut-out • Overload protection • DC offset adjustment
- Fan cooled • Power source required: 240 volts AC
- Supplied with all components, PCBs & hardware, drilled and tapped heatsinks, 120mm cooling fan, large 10,000uF 100V filter capacitors, toroidal transformer, pre-punched powder-coated case and deluxe front panel

$799



K 5582 SILICON CHIP Aug/Sept/Oct '97

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direct link

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PHONE 1300 366 644 to reserve your order

Availability: Our kits consist of many different parts from numerous suppliers. Whilst we have consulted closely with them and are satisfied as to their ability to supply, sometimes problems can arise in obtaining all of the parts. This means there is a slight chance that availability may be delayed. Rainchecks are available, however if you'd like to check beforehand, please don't hesitate to contact your local store.

Construction Project:

VIDEO ENHANCER AND STABILISER

Here's the design for a low cost unit which can improve the quality of images from poor-quality videotapes, and also reduce image degradation when you're making copies of your precious family video recordings, by allowing a judicious amount of high-frequency boosting. It also includes circuitry which can give more stable viewing of video signals, by stripping out 'piggyback' information like vertical-interval test signals and teletext data.

by JIM ROWE

Low cost video enhancer units have always been fairly popular — the last one *EA* described, back in the October 1983 issue, is still being offered by kit suppliers.

Perhaps this is because so many people like to run off copies of their family videos for distribution to relatives and friends. Generally video copies made with domestic gear are noticeably inferior to the original, due to the equipment's limited bandwidth and signal to noise ratio, but a small amount of high-frequency boosting or 'enhancement' can often reduce this degradation. The same kind of enhancement can often achieve a noticeable improvement in picture clarity when you're viewing elderly video movies, perhaps made from inferior duping masters.

More recently, there's also been quite a lot of interest in so-called video stabilisers. This seems to be in response to the way broadcasters and videotape producers have gradually added a lot of 'piggyback' information onto the basic video signals — vertical interval test signals (VITS), teletext and similar digital data. It's not uncommon for these 'hidden extra' signals to disturb the synchronisation and/or colour stability of colour TVs, monitors and VCRs, and hence reduce viewing enjoyment.

Video stabilisers are designed to remove as many of the extra signals as possible, delivering a cleaned-up 'no nonsense' PAL composite video signal which is capable of being viewed or recorded reliably and stably.

Presented here is a new enhancer/stabiliser design which provides facilities for both adjustable high frequency boosting and fixed waveform stabilisation, in a low cost and easily built unit. As a result it should be of interest to anyone involved in achieving the best results when viewing older video recordings or making video copies with the least visual degradation.

The new enhancer is built in a standard small plastic instrument box, and has only two easily used controls.

The enhancement circuitry allows fully adjustable boosting, between zero and around 8dB, at any of three selectable frequencies: 3MHz, 2.5MHz or 2MHz. There's also a 'flat' position where the enhancement can be disabled when it's not required.

The waveform stabilisation circuitry is fixed and 'transparent' in its operation, with no user controls needed. Essentially what it does is strip off any 'piggyback' signals which may be present in the vertical blanking interval, leaving a clean standard composite PAL video waveform.

How it works

The complete schematic for the enhancer/stabiliser is shown in Fig.1. As you can see it uses five discrete transistors and five integrated circuits for the signal processing circuitry, with another two voltage regulator ICs used in the power supply. All of these devices are low in cost and readily available.

Let's consider the enhancement circuitry first, because this also covers the main video path through the unit. After passing through input coupling capacitor C1, the incoming video signal is 'DC restored' with its negative sync tips effectively clamped to a level of +0.6V by the action of diode D5 and resistor R2, in conjunction with C1. Diodes D6 and D7 establish the clamp's reference voltage level, which is +1.2V to allow for the voltage drop in D5.

With the video signal's sync tip level stabilised, it passes through buffer transistor Q1 which is connected as an emitter follower. It then passes through analog switch element U1c, which at present we can consider to be 'on' and therefore essentially just a low series resistance (less than 50Ω), to the base of transistor Q2.

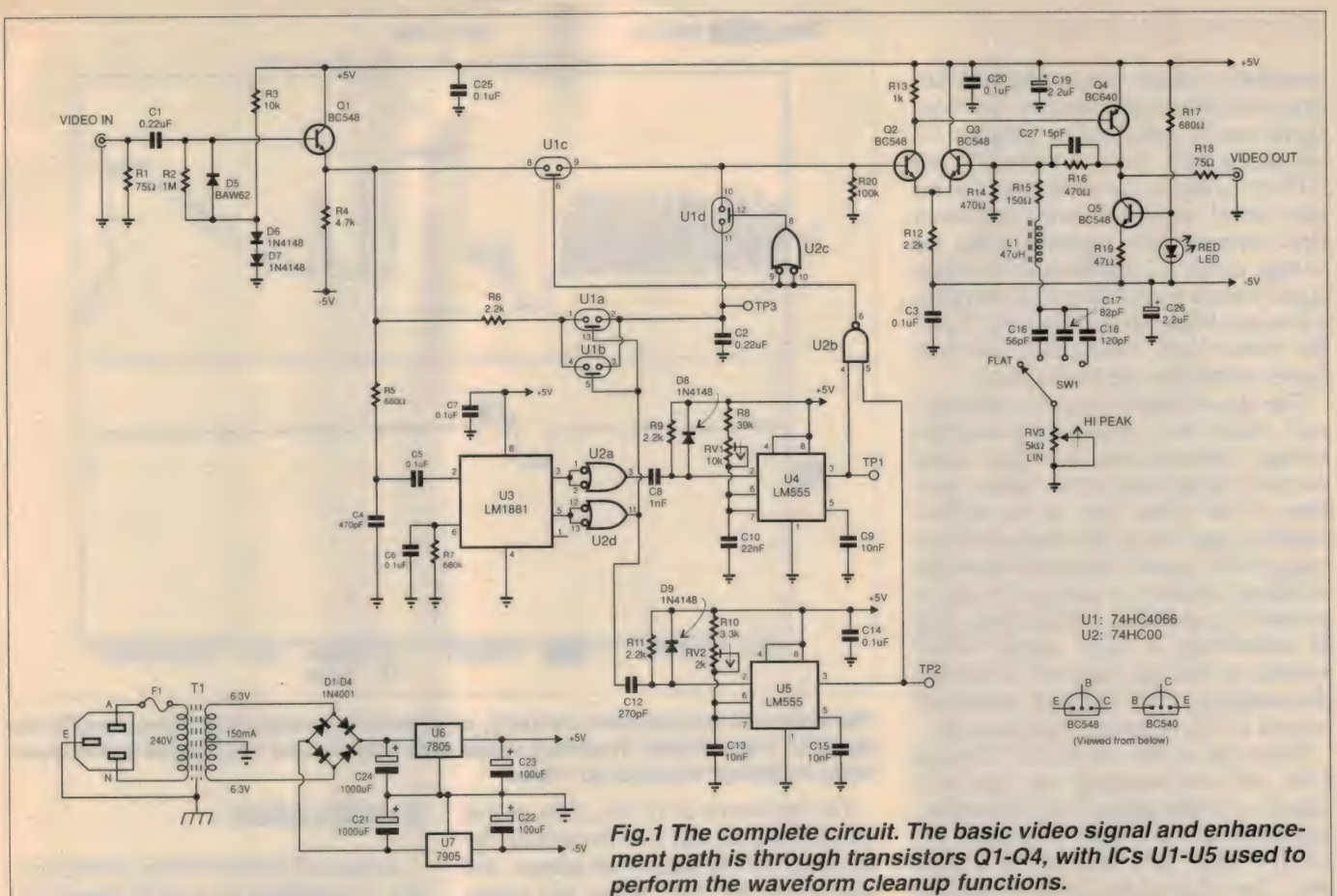


Fig.1 The complete circuit. The basic video signal and enhancement path is through transistors Q1-Q4, with ICs U1-U5 used to perform the waveform cleanup functions.

Q2 and Q3 form the input stage of a wideband video amplifier, with Q4 as the output stage. Q5 is used as a constant-current load for Q4, to provide a high AC load impedance combined with a low DC load (rather like an electronic inductor). The resulting amplifier around Q2, Q3 and Q4 has a basic gain of two, as set by feedback resistors R16 and R14, and a bandwidth of over 10MHz.

As you can see the indicator LED is used to establish a base reference voltage for Q5, in conjunction with R17. Q5 therefore attempts to pass collector/emitter current such that the voltage drop across R19 balances this voltage, less the transistor's 0.6V base-emitter drop.

The desired adjustable HF boost control for enhancement is achieved by means of R15, RF choke L1, pot RV3 and the capacitor selected by switch SW1 (if any). When one of the capacitors is selected, these components form a series-resonant circuit, with its Q adjusted via RV3. This effectively connects the series combination of R15 and RV3 in parallel with R14 at the selected video frequency, and hence has the potential to increase the video amplifier's gain at that frequency. With RV3 in the zero resistance position (fully clockwise), R15 is in parallel with R14, giving a peaking gain of about five times — or about +8dB. As RV3 is increased in resistance (turned anticlockwise) this peaking reduces, giving smooth control over the degree of enhancement.

In the 'flat' position of SW1 this boosting action is disabled altogether, for situations where no enhancement is necessary. Capacitor C16 gives peaking at around 3MHz, for signals which need enhancement only at the high end, while C17 and C18 allow the peaking frequency to be reduced to either 2.5MHz or 2MHz for signals needing more drastic 'help'.

The stabiliser

As you can see, the basic video path and enhancement system is quite straightforward. The stabilising circuitry isn't quite so easy to follow, but without going into great detail I'll try to make it reasonably clear. It will help to bear in mind that the 'extra' signals which the stabilising circuitry is designed to remove are basically all present on the lines which occur during the 'tail end' of the vertical blanking interval, just before the start of the visible picture.

From the output of input buffer Q1, we tap off some of the video signal and feed it to U3. This is an LM1881, a low-cost IC which performs virtually all of the functions of a TV sync separator in a single 8-pin package. The signal is fed to pin 2, the input of U3, via coupling capacitor C5 and also R5 and C4, which form a simple low-pass filter to attenuate the colour subcarrier.

U3 processes the video signal quite elegantly, and derives from it a number of useful signals. At pin 1 it produces a complete composite sync signal, which we're not using here; similarly at pin 7 it produces a signal which indicates 'odd' and 'even' video fields, which we're also not using in this circuit. However it also produces two signals that we *do* use here: at pin 3 it produces negative-going vertical sync pulses, and at pin 5 it produces another train of negative-going pulses which correspond to the location and timing of the colour bursts, on the 'back porch' of each horizontal blanking pedestal. By tradition this is also the correct time to sample the video signal's black level.

In our circuit we initially pass both of these signals through inverters U2a and U2d, to convert them into positive-going form.

The inverted 'burst gating' pulse is then used to turn on analog switch elements U1a and U1b. As you can see, these are connected in parallel and form what is

essentially a simple 'sample and hold' circuit, providing a path whereby the video signal can be connected to capacitor C2 via resistor R6 — but only when U1a and U1b are turned on. So as the switches are only turned on briefly during the colour burst interval, what happens is that the voltage across C2 stabilises at the video signal's black level. (R6 and C2 also form a low-pass filter, which effectively 'loses' the colour burst information and only leaves its average: the black level.)

The idea of establishing the video signal's black level across C2 is that this voltage represents the level that would normally be present on the 'active' portions of the video lines in the vertical blanking interval, in the absence of any 'piggyback' signals. What the rest of the stabiliser circuitry is designed to do is control U1c and U1d (which form what is effectively a high speed SPDT switch) so that the input of Q2 can be disconnected from Q1 and connected instead to C2, to restore this situation.

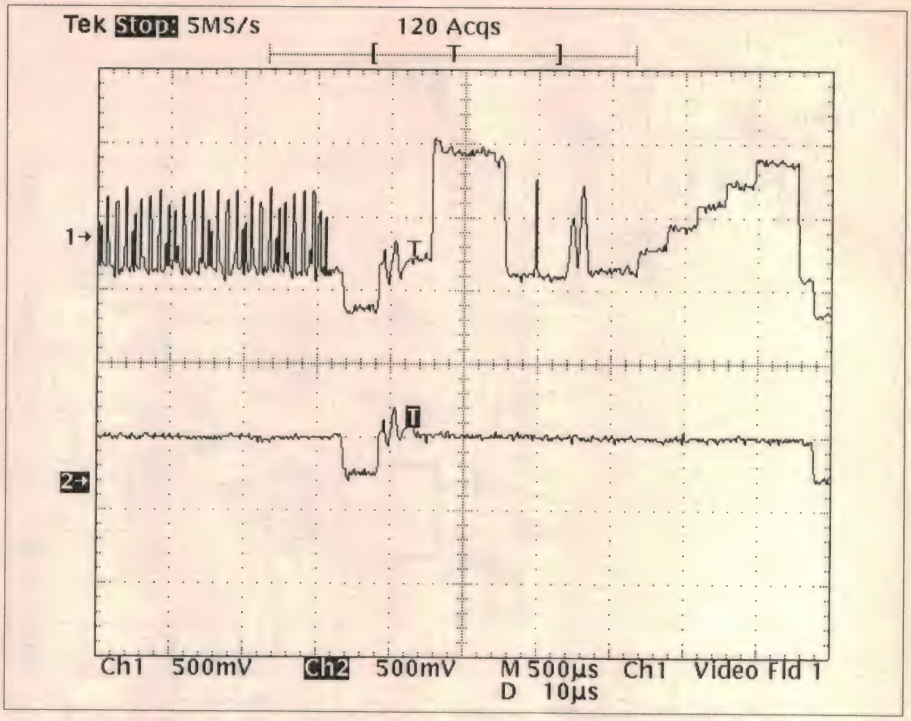
Returning to the outputs of U2a and U2d, you can hopefully see that each signal is fed through a C-R differentiating network and used to trigger an LM555 timer IC connected as a one-shot. The effect of this is that we use the signals to generate two pulses of known length and carefully arranged timing.

One-shot U4 is effectively triggered from the trailing edge of the vertical sync pulse from U3, and is used to generate a pulse which is adjusted via RV1 to last for around 1.1ms — from the end of the sync pulse to the end of the vertical blanking interval. This pulse can be checked at TP1.

Similarly U5 is triggered from the trailing edge of the burst gating pulse from U3, and is used to generate a pulse which is adjusted via RV2 to last for around 50us — from the end of the colour burst until almost the end of the active line. This pulse can be checked at TP2.

The two pulses generated by U4 and U5 are then fed to NAND gate U2b, whose output (pin 6) will therefore only fall low when both pulses are present simultaneously. This will only occur during the 'back porch' lines of the vertical blanking interval, and specifically during the 'active' part of those lines.

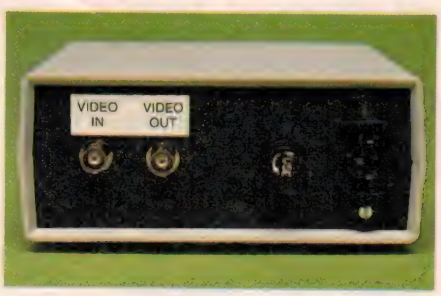
As you can see, the output of U2b is then used to control analog switch U1c directly, and U1d indirectly via U2c which is connected as an inverter. This means that when the output of U2b is high, U1c is turned on and U1d is turned off; but when the output of U2b falls low, U1c is turned off and U1d is turned on.



The action of the stabiliser circuitry, on lines in the vertical blanking period: the top DSO trace shows incoming video with teletext and VITS signals, the lower trace outgoing 'cleaned up' video.

The end result of all this, then, is that U1c remains on and U1d remains off for all of the visible part of the picture, and also during all sync pulses and colour bursts — passing all of this information through to Q2 unchanged. However during the 'active' periods only of the lines after the sync block in the vertical blanking interval, U1c is switched off and U1d on, to switch the input of Q2 to C2 and ensure that these lines stay at the correct black level. This is all done automatically and 'transparently', once RV1 and RV2 are set for the correct pulse lengths.

All of the circuit's digital circuitry runs from +5V DC, while the analog circuitry uses -5V as well. The required power supply is therefore a very simple arrangement using a low cost 12V/150mA transformer, a pair of full-wave rectifiers using D1-D4 (shown here as a bridge) and regulators U6 and U7.



As you can see, the video input and output connectors are on the rear panel along with the mains connector and fuseholder.

Construction

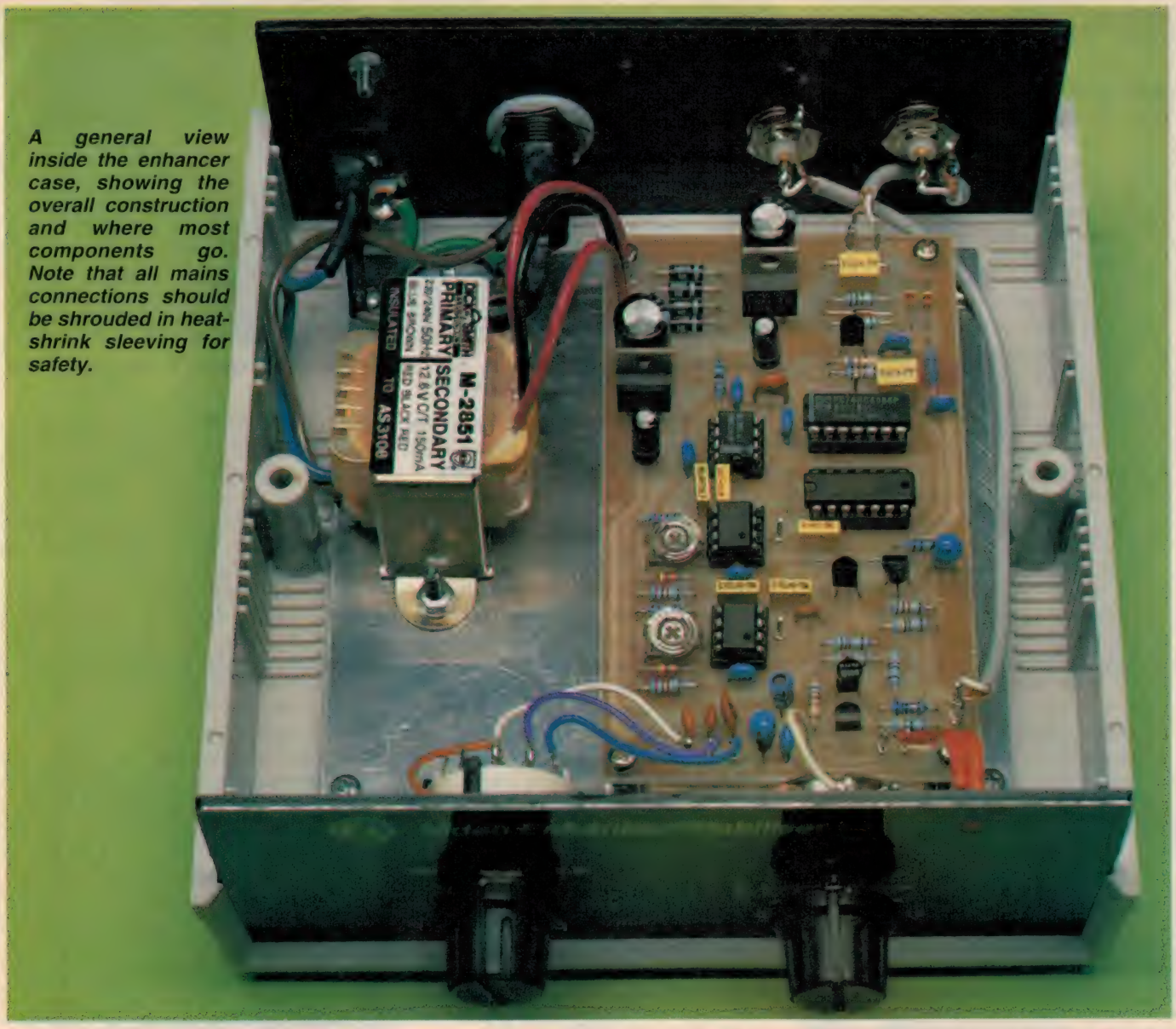
Almost all of the circuitry for the project is assembled on a small printed circuit board measuring 110 x 65mm, and coded 97ves11. This is supported in turn, via four 10mm-long insulated spacers, on a mounting/shield plate which also supports the power transformer. The plate measures 120 x 120mm and is cut from 1mm-thick aluminium sheet.

This electronics assembly is housed in a standard small plastic instrument case, measuring 160 x 155 x 65mm. The high peaking pot RV3 and selector switch SW1 are mounted on the case front panel, along with the indicator LED, while the video input and output connectors mount on the rear panel along with the IEC mains input connector and mains fuseholder.

All of this construction can be seen in the internal photos, which you should be able to use as a guide — along with the PCB overlay diagram and schematic.

When you're populating the PCB, I suggest that you fit terminal pins first for all of the off-board connections; this will make things a lot easier later. You'll need 16 pins in all, including three for the circuit test points. Then I'd fit the four links needed on the PCB; these are all in the vicinity of U2 and Q3.

After this I suggest you fit the low-profile fixed resistors, smaller capacitors and diodes, taking care with the



A general view inside the enhancer case, showing the overall construction and where most components go. Note that all mains connections should be shrouded in heat-shrink sleeving for safety.

polarity of the latter. You can also fit the preset pots, RF choke (L1) and then the higher-profile electrolytics.

Finally you can add the transistors (taking care to fit the BC640 as Q4), and the ICs. Although I used sockets to mount the latter in the prototype unit shown in the photos, there's really no need for sockets unless you prefer them; just make sure you fit them with the correct orientation, as shown on the overlay.

Once the board is fully assembled, you can mount it on the shield plate (out of the case at this stage), using the four insulated spacers. You can also mount the transformer on the plate, with its low-voltage secondary connections facing towards the PCB. The transformer mounts using 3mm x 15mm machine screws and nuts — but make sure you fit lockwashers under the nuts, to ensure that the mounting is reliably secure.

Just behind the transformer mounting position you can also mount the solder lug used to connect the shield plate and transformer frame to mains earth. This mounts again with a 3mm x 15mm machine screw and nut, with two lockwashers this time: one between the solder lug and the plate, to ensure a good electrical contact, and the other underneath the nut for physical security.

At this stage you can cut the transformer secondary leads to about 60mm long, bare about 5mm at the end of each and solder them to the three nearby terminal pins on the PCB — making sure that the centre-tap lead goes to the centre pin. You might also like to cut a 60mm length of mains-insulated earth wire (green/yellow covering), baring 6mm of wire at each end and tinning both. Then you can solder one end to the earth lug behind the transformer, with the free end ready to connect to the IEC connector later.

The completed assembly can then be mounted into the bottom half of the plastic case, using four of the small self-tapping screws supplied. It's then time to prepare the front and rear panels.

The front panel is fairly straightforward, requiring only three main mounting holes — one each for the switch and pot, and a third smaller hole (about 3mm) for the LED. If you're preparing the panel yourself, you can use an actual-size photocopy of the front panel artwork as a drilling template. Once these main holes are drilled and reamed to size, you may also wish to fit the two controls temporarily and use their locating spigots to mark the best positions for matching small blind holes (to ensure that the controls can't rotate, when they are finally mounted). The blind holes can then be drilled, from the rear of the panel.

The control spindles can then be cut to length, if necessary, and de-burred.

After this the controls can be fitted properly, and the knobs added. You may also wish to add the LED to the panel, after extending its leads to about 45mm long so that they'll later reach the pins on the front of the PCB. After fitting from the rear it can be cemented in place with a dob of glue.

With the front panel prepared, you can turn your attention to the rear panel. This will need two D-shaped holes for the BNC connectors, a somewhat larger O-shaped hole for the fuseholder and the usual rectangular or 'rectangle-with-two-chamfered-corners' hole (depending on your skills and patience) for the IEC mains connector. The mains connector will also need two 3mm holes, for its 3mm x 10mm countersink-head mounting screws.

Once all of these holes have been prepared and de-burred, you can mount the remaining components carefully. Make sure that you use lockwashers under the mounting nuts for the IEC connector, so that it won't come loose. You may also want to bend up the ends of the BNC connector earthing lugs, to allow easier soldering of the video lead earth braids.

You should now be ready for the final assembly phase, which involves connecting the front and rear panel parts to the PCB. The front panel connections are very straightforward, and can all be made with the panel assembly fitted into its case slot. The connections from the PCB pins to SW1 and RV3 are all made via four short lengths of insulated hookup wire (about 45mm long), with another length of the same wire (about 80mm long) used to connect the rotor of SW1 to the 'fully clockwise' end lug of RV3.

Another view inside the case, this time showing the wiring to the front panel controls and the front of the board.

The extended leads from the LED can also be connected to the remaining two pins on the fron of the PCB, making sure that the LED anode lead connects to the pin nearer Q5.

Next you can complete the mains wiring, taking care to fit heatshrink sleeving over each exposed joint after it's made. The transformer primary neutral lead (blue) goes to the IEC connector's 'N' lug, while its active lead (brown) goes to the *side* lug on the fuseholder. Both leads should be cut to a length sufficient to run to these points without strain, when the panel is fitted into the case. From the excess brown lead, you should be able to run a short lead connecting the IEC connector's 'A' lug to the remaining *end* lug of the fuseholder.

With these joints all made and shrouded in protective heatshrink tubing or similar, you can fit the rear panel into its case slot and solder the free end of the mounting plate earth lead to the centre 'E' lug of the IEC connector. This joint need not be shrouded in heatshrink sleeving — in fact it's probably a good idea to leave it 'naked', so that the joint is clearly visible for inspection.

The two remaining connections are those between the PCB and the video BNC connectors. These are both made in very light co-axial cable, or even audio shielded cable if you have some. The input lead can be very short, as the PCB pins are quite close to the connector. (You could probably use two short lengths of hookup wire, if you prefer.) The output lead needs to be about 150mm long overall, as its PCB pins are down near the front of the board. The shield braid of both leads is connected at each end.

Your enhancer/stabiliser should now be complete, and ready for functional testing and setup.

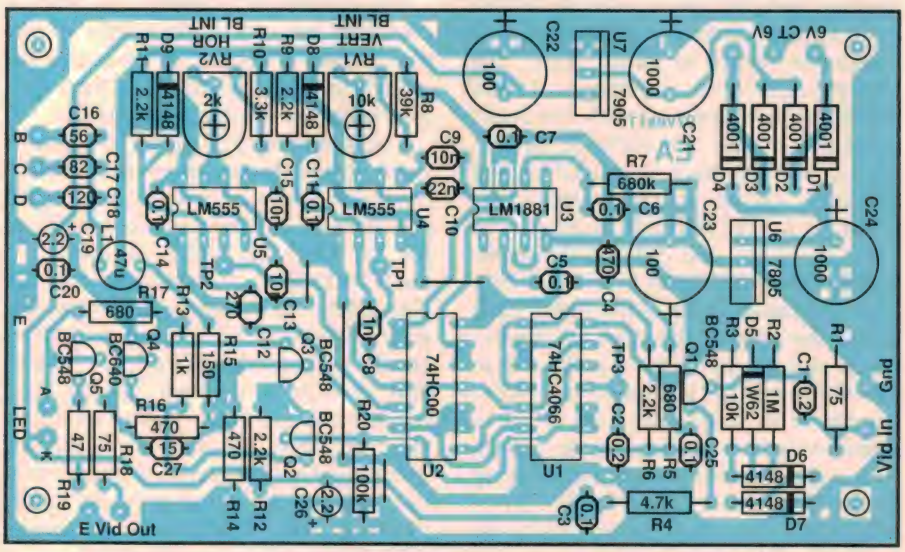


Fig.2: Use this PCB overlay diagram as a guide when you are wiring up your own board. Terminal pins B, C, D and E connect to the front panel controls.

Testing & setup

Before applying power, set both preset pots on the board to their fully anti-clockwise position. Then apply mains power, and quickly check to see if the LED begins glowing. If it doesn't, the odds are that you've wired it in the wrong way around, so switch off and reverse its connections.

If (or when) the LED does glow correctly, quickly check the DC supply rails with your DMM/multimeter. The +5V rail can be checked at the end of R3 nearest U6, while the -5V rail can be checked at the end of R4 nearest C3. If both voltages measure correctly to within a few tens of millivolts, your power supply is working correctly and you should be ready for the setup procedure.

You'll need a source of video signals (perhaps the video output of a VCR) and a monitor or TV set (with direct video input) to perform the setup, and ideally also a scope with pulse width measurement capabilities. However the

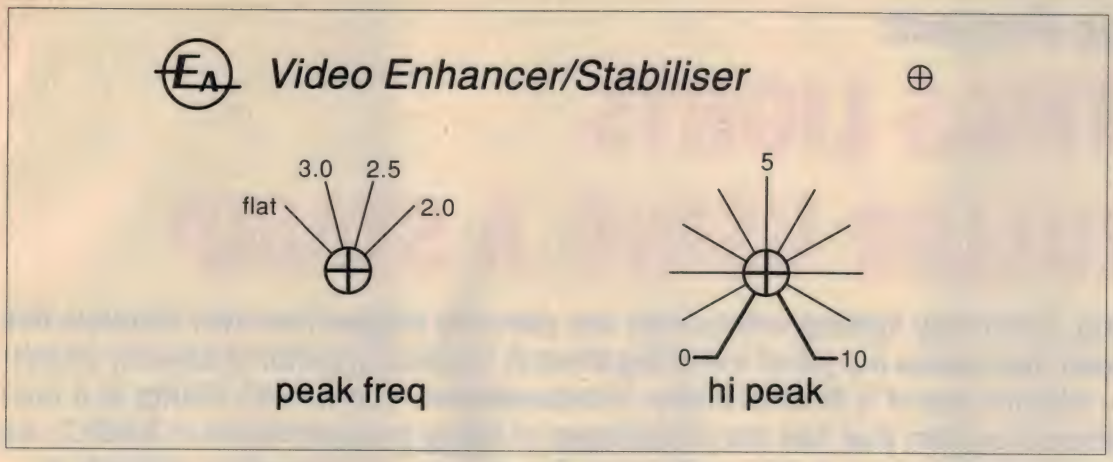


Fig.4 (left): The artwork for the enhancer front panel, shown here actual size in positive form. You may prefer to use a negative version, as shown on the prototype.

Fig.3 (below): The etching pattern for the enhancer PCB again shown actual size.

latter isn't absolutely essential, so don't worry unduly if you don't have access to one.

First of all, connect up the video source to the enhancer's input, and connect its output to your monitor/TV. With the unit powered up, you should be able to see the video displayed normally, and be able to adjust front panel controls SW1 and RV3 to achieve varying levels of enhancement. (If you turn up RV3 too far, you'll see the 'ringing' effect caused by overboosting of the higher video frequencies.)

The final step is to adjust the two preset pots RV1 and RV2, for the correct gating pulse lengths. If you have a scope, this is very straightforward; you simply measure the positive pulse width on TP1, and adjust RV1 until it's close to 1.1ms. Then you transfer your probe to TP2, and adjust RV2 until the positive pulse width measures 50-51us.

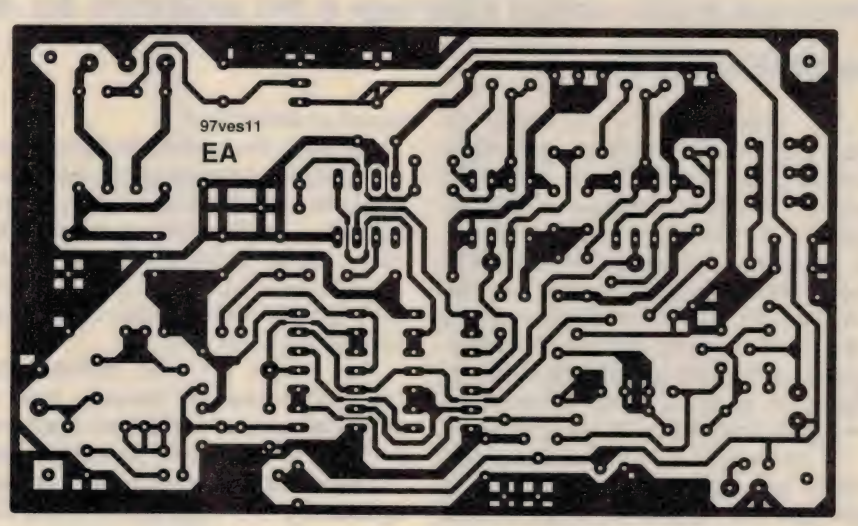
What if you don't have a scope with measurement capabilities? You can still do the adjustment reasonably well, using the video monitor or TV as a guide.

First, try advancing RV1 slowly clockwise until you see a 'black bar' beginning to creep down into the very top of the picture. It will probably be less than the full width of the picture, and over at top left.

Leave the bar visible for the present, and then carefully turn RV2 clockwise. You should see the bar gradually grow in length, and advance towards to the right-hand side of the picture. Stop adjusting RV2 when it's almost to the right-hand side, but not quite. This is the best setting for RV2.

Now return to RV1, and carefully turn it back anticlockwise until the bar has just disappeared from the top of the picture. In the absence of a scope, this is the best setting for RV1.

Your Video Enhancer/Stabiliser should now be fully set up, and ready for use after you fit the top half of the case. ❖



Parts List

Resistors

(All 1% 1/4W metal film unless specified)

R1,18	75 ohms
R2	1M
R3	10k
R4	4.7k
R5,17	680 ohms
R6,9, 11,12	2.2k
R7	680k
R8	39k
R10	3.3k
R13	1k
R14,16	470 ohms
R15	150 ohms
R19	47 ohms
R20	100k
RV1	10k lin horiz trimpot
RV2	2k lin horiz trimpot
RV3	5k linear pot

Capacitors

C1,2	0.22uF 100V MKT
C3,5,6, 7,11,14, 20,25	0.1uF monolithic
C4	470pF disc ceramic
C8	1nF 100V MKT
C9,13,15	10nF 100V MKT
C10	22nF 100V MKT
C12	270pF disc ceramic
C16	56pF NPO ceramic
C17	82pF NPO ceramic
C18	120pF disc ceramic
C19,26	2.2uF 10VW TAG tantalum
C21,24	1000uF 16VW RB electrolytic
C22,23	100uF 10VW RB electrolytic
C27	15pF disc ceramic

Semiconductors

D1-4	1N4001 silicon diode
D5	BAW62 silicon signal diode
D6-9	1N4148 silicon signal diode
Q1-3,5	BC548 NPN silicon transistor
Q4	BC640 PNP silicon transistor
U1	74HC4066 quad bilateral switch
U2	74HC00 quad NAND gate
U3	LM1881 sync separator
U4,5	LM555 timer
U6	7805 positive 5V regulator
U7	7905 negative 5V regulator
LED	3mm red LED

Miscellaneous

L1	47uH RF inductor
SW1	Single pole four-position rotary switch
T1	Transformer, 240V to 12V CT at 150mA

Plastic instrument case, 160 x 155 x 65mm; three-pin IEC mains plug, panel mounting; screw-type 3AG fuseholder, panel mounting; 250mA 3AG mains fuse; 2 x BNC sockets, single hole panel mounting; 2 x instrument knobs; 120 x 120mm square of 1mm aluminium sheet, for mounting/shield plate; 4 x 10mm insulated spacers with screws and lockwashers; 3 x 15mm x 3mm dia round-head machine screws with nuts; 2 x 10mm x 3mm dia countersink-head machine screws with nuts; 6 x star lockwashers; 1 x solder lug; 16 x 1mm dia. PCB terminal pins; 200mm length of light coaxial cable; hookup wire, solder etc.

Construction Project:

CHRISTMAS LIGHTS CONTROLLER USING A STAMP

Christmas is coming, and many lighting enthusiasts are planning bigger-than-ever displays this year. Here is a project that makes the job of switching them in interesting patterns as easy as eating a mince pie — with the aid of a BASIC Stamp microcontroller. The BASIC Stamp is a low-priced and very compact system that has the advantages of being programmable in BASIC. Its small size is not a special advantage in this application, but its easy programming certainly is.

by OWEN BISHOP

The system to be described is designed for the control of up to eight double-pole double-throw (DPDT) relays, with each contact-pair rated at 240V 10A. As these are double-throw, or changeover contacts, you can switch some banks of lights on as others are switched off. Altogether this gives you a very flexible system capable of independently controlling up to eight banks of lights, or up to 32 banks if some are switched simultaneously with others.

Of course you may not be that ambitious (or wealthy?), so we have designed the system to work with a Master Board holding the Stamp circuit and just two DPDT relays. An optional Extension Board holds three more relays, controlled from the Master Board. The complete system with eight relays consists of the Master Board plus two Extension Boards, which can either be built at the same time as the Master Board or added later.

Although the project was designed for switching Christmas lights, it can just as easily be used for switching other kinds of lights — such as in shop-window displays and the lighting on models. It can be used with AC mains power or with DC, but with DC the relay contacts are limited to 10A at 30V.

The system can also include other electrically-powered devices, such as small DC motors, a projector, a radio set or a tape or CD player. It could be used for automatic control of a model railway system. Devices running on AC and DC, or operating at different voltages, will need to be switched by separate relays.

How it works

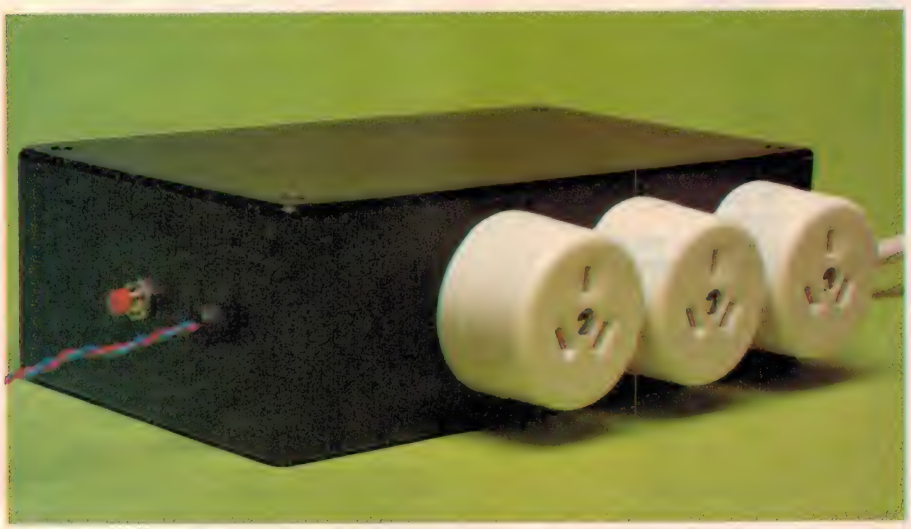
Fig.1 shows the circuit for the Master Board. The BASIC Stamp module is held in a 14-pin single-in-line socket (SK1). In a previous Stamp project we used the Stamp's own mother board to hold it, but for this project it is more convenient to transfer it to our special Master Board. The board is powered by a 12V battery or a 12V regulated plug-in power supply unit (plug pack). The relays need about 40mA each, so eight relays take 320mA, and a 500mA PSU is required. If you are intending to install fewer relays, you can manage with a 300mA supply.

Note that the power supply must provide DC. Although relays can switch either AC or DC, microcontrollers and transistors operate only on DC. Although the Stamp has its own on-board 5V regulator, we have specified a regulated 12V supply because unregulated supplies deliver more than their stated voltage when only small amounts of current are drawn. With only the Stamp taking power, the voltage at its supply terminals could exceed the maximum 15V. So it's better to be safe and use a regulated supply (or a battery).

It is feasible to program the Stamp on its motherboard, then plug it into SK1, but you are sure to want to modify the program a few times while setting it up, so it is easier to program with the Stamp plugged into SK1, with SK2 connected to the computer. SK2 is a three-way header plug for connecting to the parallel port of your PC, using the lead supplied with the Stamp kit.

Note the 'double V' markings on Figs.1 and 2, corresponding with similar markings on the three-way socket end of the PC/Stamp connector lead. The connector lead is removed after programming because at that stage the program is stored permanently in Stamp's memory, and runs automatically as soon as the 12V supply is switched on.

The Stamp's mother board has a Reset button, and we have included one in our



The author's lights controller, built into a plastic utility box. The mains cable visible at far right provides power only for the lighting outlets, via the relays. The circuit's own power comes via the twisted low-voltage leads on the left.

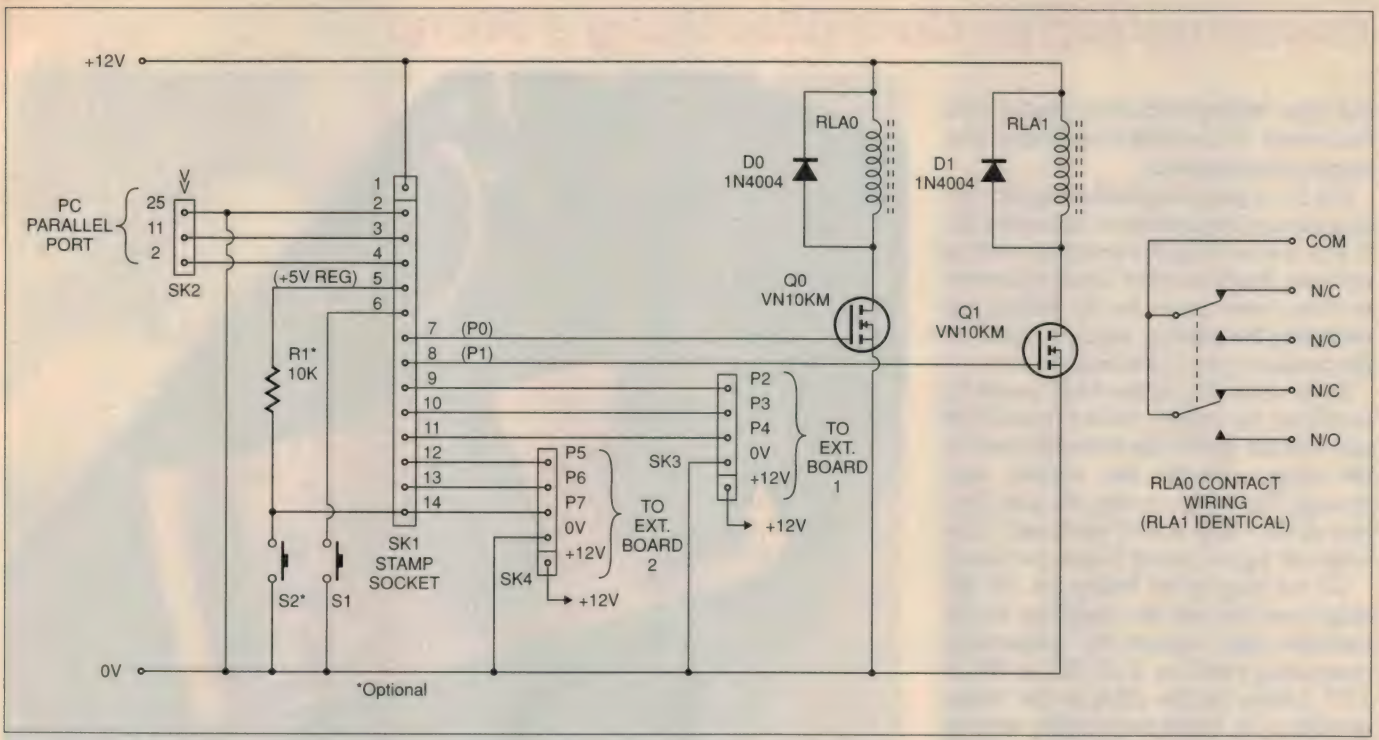


Fig.1: The Master Board schematics. The BASIC Stamp module plugs into socket SK1, and controls relays RLA0 and RLA1 via a MOSFETs Q0 and Q1. Additional relays can be controlled via extension boards, which plug into sockets SK3 and SK4.

circuit as S1. The other button in this circuit (S2) is optional. As explained later, it is used for producing an input to pin P7 to give control over the program, but you may not want to implement this function. P7 is held at logic high by the pull-up resistor R1. The input goes to logic low when S2 is pressed. If you use this input, you will not be able to use P7 to control a relay, so your system will control a maximum of 7 relays.

Fig.1 shows two relays (RLA0 and RLAY1), both of which are on the Master board, switched by two MOSFETs (Q0 and Q1) under the control of Stamp outputs P0 and P1. The diodes D0 and D1 are important to protect the MOSFETs from possible damage caused by large reverse voltages induced when the inductive load of the relay coils is switched off. Some types of relay have built-in protection diodes and, if you use this type, you can omit D0 and D1.

The switching configuration for each relay is a pair of DPDT switches with their common contacts wired together. If you want to switch two separate circuits (say, at different voltages or perhaps one DC and one AC), you could amend the PCB layout to isolate the common terminals, but the switches will still operate together.

Connections to the Extension Boards are provided through SK3 and SK4. These are five-way SIL header plugs, which also include supply lines for 0V and +12V (but not the Stamp's regulated +5V). These boards simply repeat the MOSFET switching circuits three times each.

Fig.3 shows the layout of the Extension boards. These simply repeat the transistor/diode/relay part of the circuit three more times. These circuits are controlled from the Master board by a five-wire cable plugged on to the five-way header plug, SK5. Note that the header is orientated the other way up from that in the Master Board. That is, with the 12V line at the top instead of at the bottom.

Construction

A survey of lighting sets available in major stores shows that there are two main types:

(1) 240V lamps connected directly to the mains. The total wattage is the number of lamps multiplied by their individual wattage. For example, a typical set of 10 party lights, rated at 25W each lamp, uses a total of 250W. At 240V the continuous current required is 250/240 (P/V) amps, or a little over 1A.

(2) Low-voltage (usually 12V or 24V) low-wattage lamps powered through a mains transformer. The calculation is the similar to that above. For example, a typical set of 150 fairy lights rated at 0.35W each uses a total of 52.5W. Allowing for slight loss of power in the transformer we can estimate that the transformer runs at 60W and at 240V requires 60/240 amps, that is around 0.25A.

Both currents are well within the specification of the relays chosen for this project, which means that contact arcing will be minimal. If you use lamp sets of type 1, you will need to connect the relays directly to the mains and must use mains type three-pin sockets as outlets. Although lighting sets do not usually have the third 'earth' pin, we recommend that your sockets should have their earth pins wired to the mains earth, just in case somebody should decide to plug in a device which needs an earth for safety.

If you use low-voltage lamp sets you have the option of plugging the transformer into one of the mains outlets as described above (Fig.4a). The lamps are controlled as the relay switches the transformer on and off. Or you can supply the controller from a low-voltage transformer (Fig.4b), plugging the lighting cable into low voltage sockets on the controller case.

The second of these options is safer in that there is less risk of mains voltages getting to the wrong places. But if, as is likely, you are intending to control several sets of lights, it is simpler to use a single transformer that is rated to supply sufficient current for all sets simultaneously.

It is of course possible to mix the systems, supplying some lights from the mains and others from a transformer. If you do this, check your wiring diagram

and your wiring with even greater care than usual, for a mistake could have disastrous consequences.

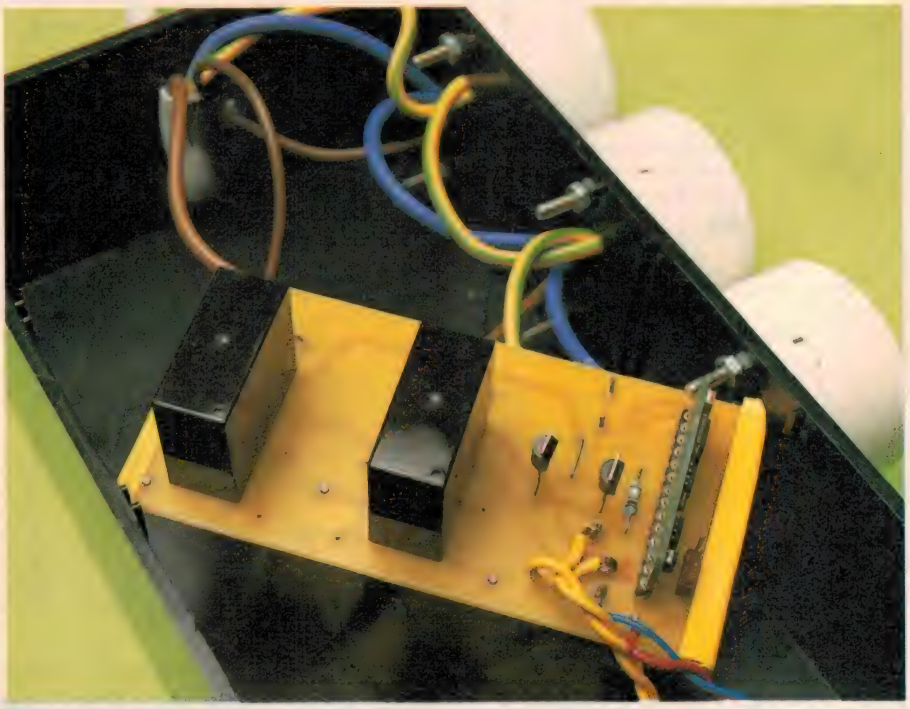
Fig.5 is a guide to positioning the various parts of the system in the enclosure. If you are building the complete system you may decide to use a bigger enclosure to allow more space for the wiring and mounting the sockets. Much depends on the details of your switching scheme.

Begin assembly of the Main Board by installing the relays, diodes, transistors and sockets. Insert the terminal pins for the relay contacts the reverse way through the holes, so that the pins project on the track side of the board. This keeps all mains wiring below the board.

Do not plug in the Stamp yet. At this stage you can test the operation of the transistor/relay circuits by temporarily connecting pins 7 or 8 of SK1 to 0V or 12V. Listen for the click as the relays operate — or, better, temporarily wire up one of the circuits of Fig.6 and confirm that the lamp or LED lights up when expected. A simpler check is to switch a test meter to a resistance range and connect it across the pairs of relay terminals.

The power wiring must be made with cable rated to take the voltage and currents expected. Err on the safe side if in doubt. Use a grommet where the supply cable enters the enclosure and secure the cable to the inside of the enclosure with a cable clip. Drill the side of the enclosure with holes for the wires to pass through and for the bolts which secure the sockets in place.

When wiring is complete check it thoroughly with a test meter set to a resistance or continuity testing range. Check that there is continuity between all earth (E) terminals and between all mains neutral (N) terminals. Also check that there is NO continuity between mains active (A) and neutral, active and earth and between all of the mains lines and the DC 12V positive and negative lines.



Inside the author's prototype, with the Master board swung up to show the small number of parts involved. The tape along the ends was added to ensure the board fits snugly in the case slots.

Testing

Before connecting the project to the mains, test the control circuits as follows. Connect the Master Board to the PC parallel port using the special programming lead. The edge of the connector which has an arrow on it goes toward the 'double V' in Fig.1.

Connect the 12V power supply. Now run the Stamp program on your PC and key in this simple test program:

```
'Test it
dirs = %11111111
b0=0
high b0
pause 2000
low b0
end
```

TABLE 1

Time			Relay			Decimal
(s)	4	3	2	1	0	
0.0	1	1	0	0	1	25
0.5	1	0	0	1	0	18
1.0	1	1	1	0	0	28
1.5	0	0	0	0	1	1
2.0	0	1	0	1	0	10
2.5	0	0	1	0	0	4
3.0	1	1	0	0	1	25
3.5	1	0	0	1	0	18
4.0	1	1	1	0	0	28

The first line (beginning with an apostrophe) is the title of the program, just to identify it. The 'dirs' command sets all pins as outputs. The next line sets memory byte b0 to the number of the relay we want to test. The command 'high b0' makes the output from pin 0 (P0) go high, to turn on Q0 and thus energise the relay coil. The pause then delays the program for 2000 milliseconds, keeping the output high for two seconds. Next the output is made low and the program ends.

Having keyed in this program, press 'ALT' + R to run it. Provided that all is well, the program downloads and runs. If it does not, check that connections between the PC and Stamp are correct and that the 12V power is switched on. The computer will report any errors of syntax you have made when typing in the program.

As the program runs, the RLA0 is energised for two seconds, switching on the lamp or LED.

Repeat this test for all the relays, altering the third line of the program to 'b0=1' and so on. As a check on the reset function, briefly press S1 while the lamp is lit; this sends the program back to the beginning so the 'on' period is extended.

If you prefer it, you can continue by trying out some of the programs below, using lamps or LEDs (Fig.6) instead of the actual sets of lamps you will be

using eventually. Or, having checked the power wiring with a meter as described above, you can plug in two or more sets of lights. But before doing this make certain that the lid of the enclosure is screwed firmly down. **As a safety precaution, make it a rule NEVER to open the enclosure while the circuit is connected to the mains.**

First flashes

In the programs which follow, we assume that you have not installed R1 and S2 on the board, so all Stamp pins are available for driving relays.

The essential point about Christmas lights is that they flash on and off continuously. In other words, the program must repeat indefinitely. One way of doing this is to use a 'goto' at the end to send it back to the beginning each time.

The program below needs two lamps, LEDs, or sets of mains-powered lights connected to relays 0 and 1. The two are made to flash alternately:

```
'Alternate flash
dirs=%11111111
start:
high 0
pause 2000
low 0
high 1
pause 2000
low 1
goto start
```

The word 'start', followed by a colon, defines a *label*. This identifies a place in the program to which Stamp can return.

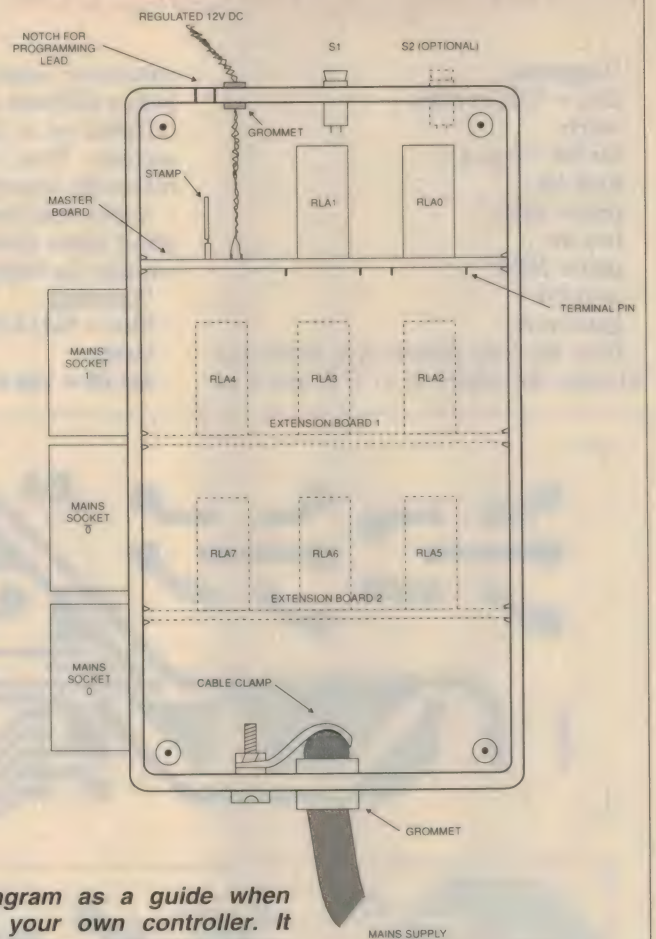
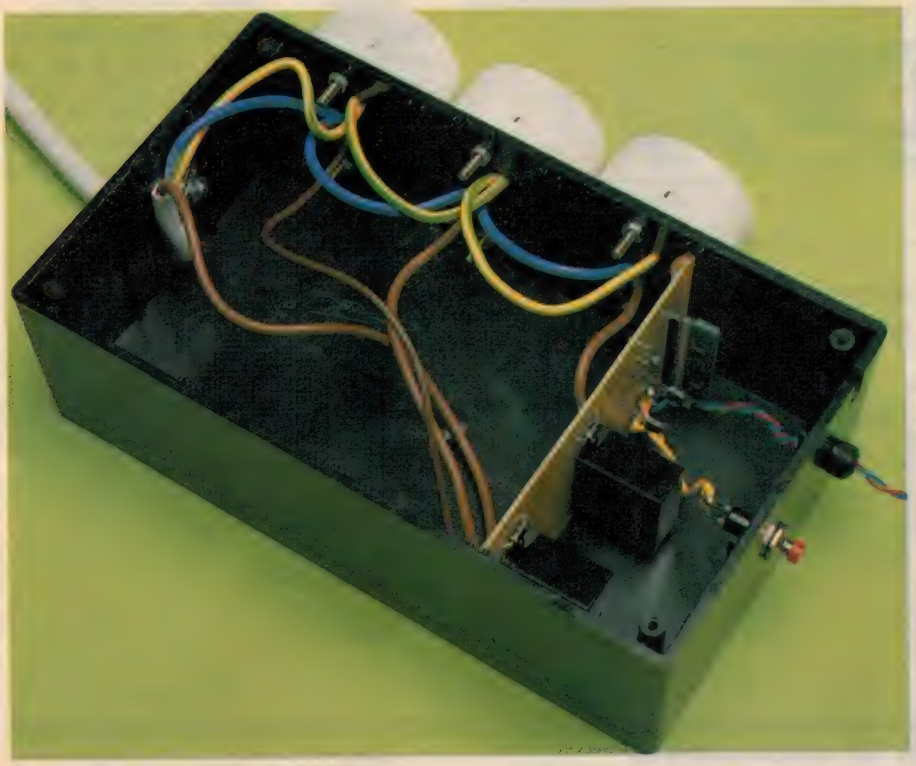


Fig.5: Use this diagram as a guide when you're assembling your own controller. It shows the general layout, including where the Master and optional Extension boards go.



The program activates relay 0 first, for five seconds, then switches it off and activates relay 1 for five seconds. Then the Stamp is instructed to 'goto' the start label and begin again.

This program runs until you switch off the power, or download and run a different program. You can vary the effect by increasing or decreasing the lengths of the pauses, but do not make them less than about 150 milliseconds. Rapidly switching the relays on and off may produce current surges which damage the contacts. You can extend the program by including lines to switch other relays.

Another way to make the program repeat is to use a 'For ... next' loop. The advantage of this is that we can make something different happen each time through the loop. Try this:

Another view inside the author's prototype, showing the way things are laid out. Optional pushbutton S2 was not fitted, nor were there any Extension cards.

Christmas Lights Controller Using a Stamp

```
'Sequence
dirs = %11111111
start:
for b0 = 0 to 4
high b0
pause 2000
low b0
pause 2000
next b0
goto start
```

Here the loop repeats five times and b0 takes the values 0, 1, 2, 3, and 4 in successive loops. Each time round the loop a different relay is energised and a different set of lights comes on for two seconds. Then the 'goto' at the end makes the sequence repeat.

In this next program we have only one set of lights (controlled by relay 0) but we alter the timing:

```
'Speedup
dirs = %11111111
start:
for b0 = 100 to 5 step -5
high 0
gosub delay
low 0
gosub delay
next b0
goto start
delay:
for b1 = 1 to b0
pause 10
next b1
return
```

This time the loop counter variable (b0) begins with a value of 100 (producing a delay of one second, that is 100 pauses of 0.01s each) but this is reduced by five each time round the loop. So the loop runs faster and faster and the light flashes on and off at an increasing rate.

It is possible to combine the routines of these two programs and let the loop variable determine which relays are turned on and for how long, each time through the loop. You could also try using an inner loop nested inside an outer loop:

```
start:
for b0 = 1 to 5
for b1 = 2 to 100 step 2
        ... switch on lamp (or lamps)
          according to the value of b0
        ... pause(s) according to value
        of b1
next b0
next b1
goto start
```

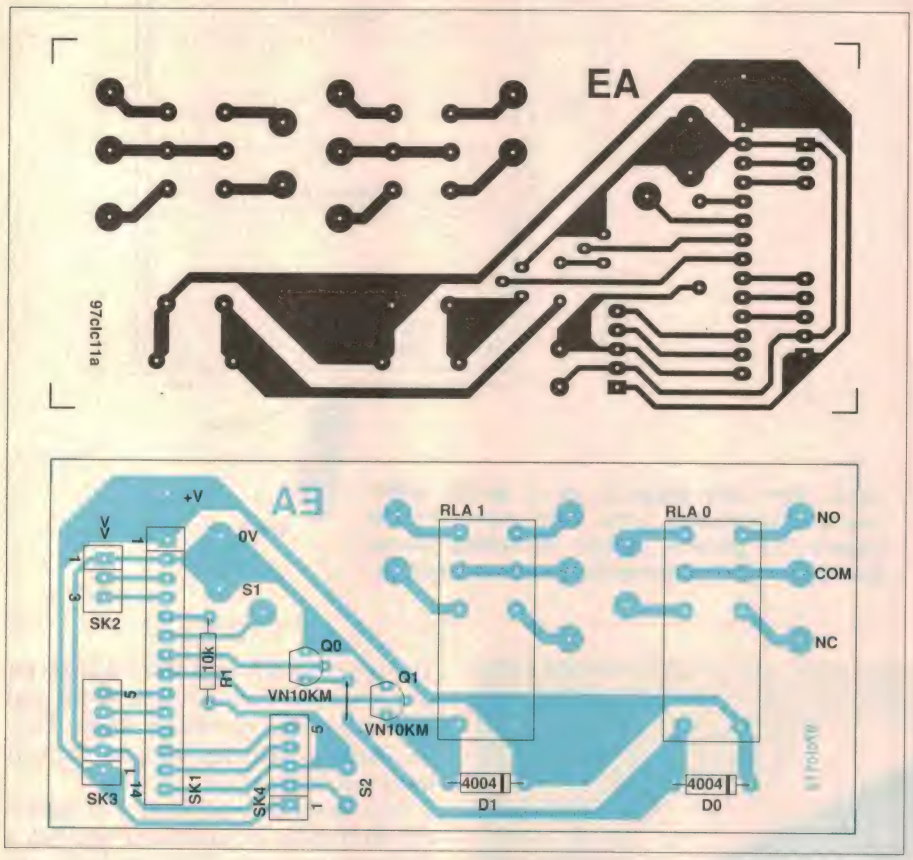


Fig.2: The etching pattern for the controller's Master board is at top left, with its wiring and parts overlay diagram below it. Note that the connections to the relay contacts should be made to the copper side, for added safety.

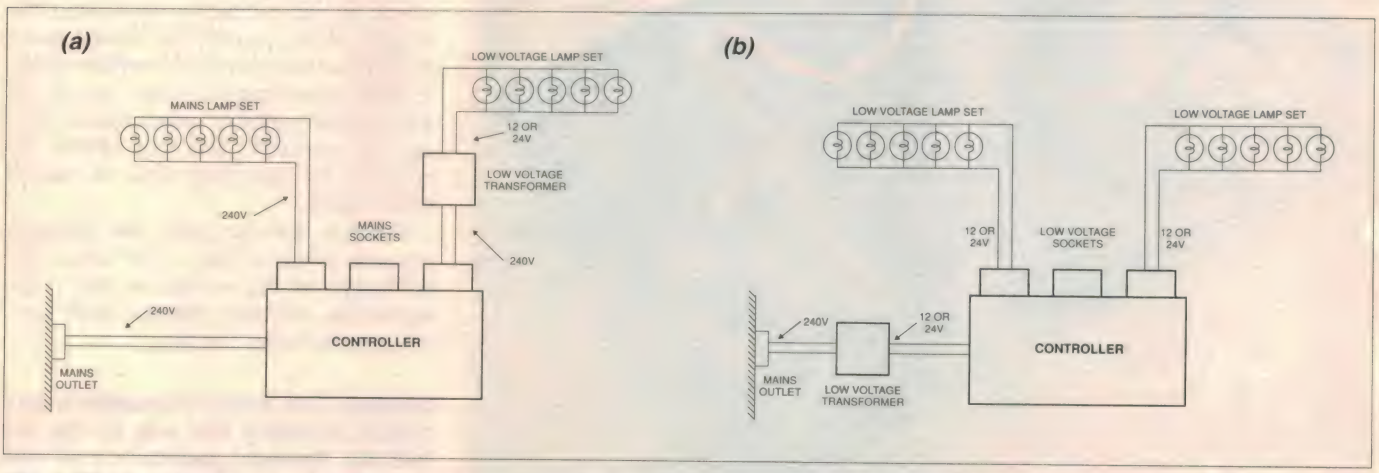


Fig.4: The two basic ways in which the controller can be used to control lights. In (a) at left the relays are used to switch 240V, while (b) shows the arrangement for low voltage switching.

Stamp can handle loops nested up to eight levels deep, so there is plenty of room for experimentation in this direction!

Lookup tables

Using the simple techniques outlined in the previous section it is possible to develop some interesting and dramatic lighting displays. But for anything but the most elementary effects the programs become very complicated to write and too long to fit into Stamp's memory.

For really elaborate and spectacular lighting schedules that do not require lots of memory, look-up tables help us to design display schemes in a systematic yet flexible way.

Think of the eight relays as being represented by a single byte of data. We use byte b0, but you could use any other. In this byte, a zero represents 'output low'; the transistor is off and the relay not energised. Lamps connected to the normally open (n/o) contacts are off, but lamps (if any) connected to the normally closed (n/c) contacts are on. A '1' in the byte means the state opposite to the above, in which lamps connected to the n/o contacts are on.

To simplify the description from now on, we will refer only to lamps wired to the n/o contacts. Thus the byte '01100001' indicates that lamps connected to relays 1, 6 and 7 are on and the others off. Note that by convention we read the byte from digit 0 on the right to digit 7 on the left. In this way a single byte defines the states of all the relays — in fact the whole system.

Now if we want the system to run through a sequence of steps, we simply define a set of bytes to describe each step. For example, switching on the relays in turn from 0 to 7 can be specified by eight bytes: 00000001, 00000010, 00000100... and finally 10000000. Byte by byte the '1' is simply shifted from right to left.

Stamp understands binary numbers such as these if we precede them by %, as we usually do in the 'dirs' command. However, decimal is more compact, so we write the numbers as 1, 2, 4, 8, 16, 32, 64 and 128. This is the basis of a lookup list:

```
'Lamps in turn
for b0 = 0 to 7
lookup b0,(1,2,4,8,16,32,64,128),b1
pins = b1
pause 2000
next b0
end
```

Each time round the loop a value is taken from the lookup list in brackets. Which one is taken depends on the value of b0, with the values in the list being indexed from 0 to 7. This value is stored in variable b1, and used to set the output of all eight pins simultaneously. The loop runs eight times, selecting a different value from the list each time and energising the relays in turn, from 0 to 7.

The list below switches on the relays one after another until they are all on, then turns them off one at a time:

(1, 3, 7, 15, 31, 63, 127, 255, 254, 252, 248, 240, 224, 192, 128, 0)

To use this list fully, alter the second line of the program to 'for b0 = 0 to 15'. Convert these numbers to binary to see exactly what the effect is like. A pocket calculator with binary/decimal conversions is helpful.

For the popular 'chasing light' effect you need three sets of lights — A, B and C — controlled by three relays, the lamps being arranged in a single row: ABCABCABCABCA... Only one set is on at any one time. First all the A's are on, then all the B's, then all the C's, and repeating. This makes it appear that the 'on' lights are chasing each other along the array. The repeated switching sequence for this is: 001, 010, 100, or in decimals 1, 2 and 4.

This program needs only three

(Continued on page 87)

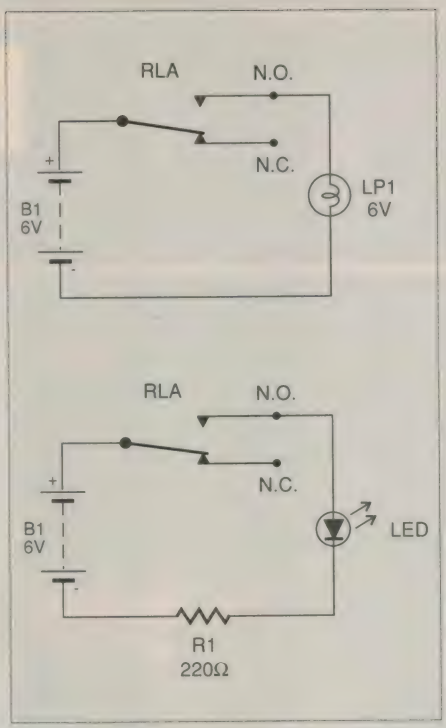


Fig.6 (above): Simple test circuits for the controller, using either a 6V lamp globe (top) or a LED and series resistor, in each case with a 6V battery.

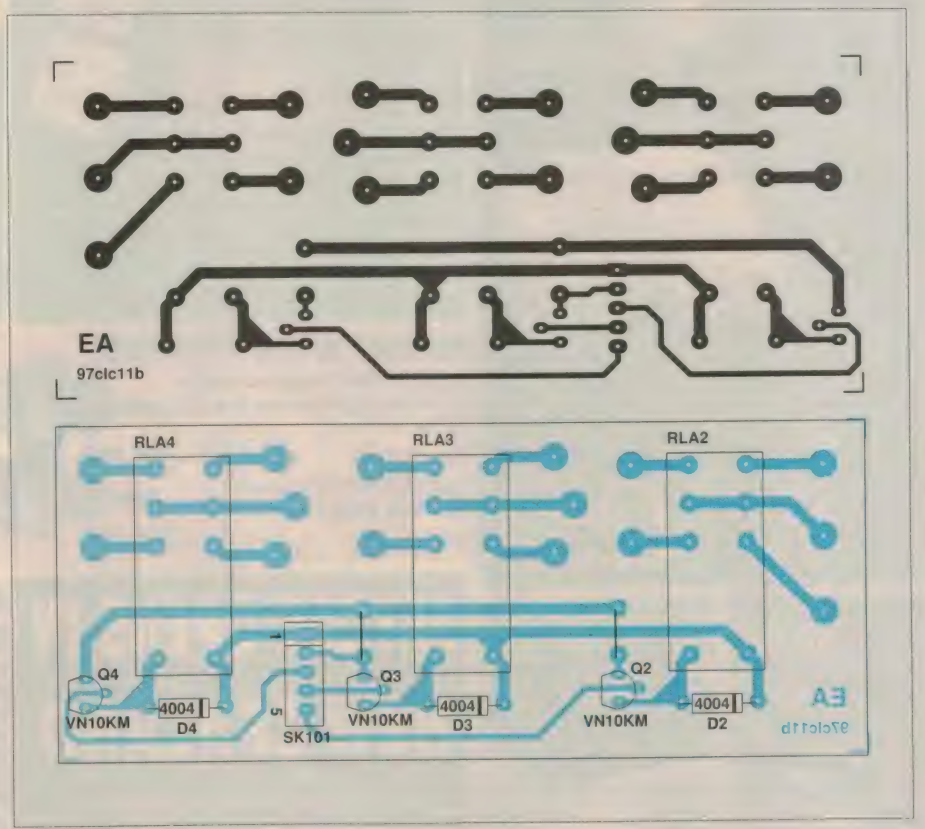


Fig.3: The etching pattern for the optional Extension boards (top), together with the matching wiring and parts overlay diagram. As you can see, very few extra parts are needed.

Jaycar ELECTRONICS NOVEMBER SALE

Prices valid until November 30th.

12 VOLT COMPACT FLUORESCENT LAMPS

NEW

Its a common known fact that compact fluorescent lamps use less power to give the same lighting as normal lamps. We have 2 new lights available. These are ideal for caravans, boats, cars, bush houses etc.

DUE EARLY NOVEMBER

PL9W CABIN LIGHT

This uses a 2 pin PL9 watt tube, which is about equal to a 60 watt globe.

There is also a 3 watt courtesy light included, which can be used to give a small amount of light - (to see steps etc). An electronic ballast is used, guaranteeing low current consumption, and it is protected against incorrect battery connection. A 3 position rocker switch is used - centre is off, one way turns the courtesy light on, and the other way turns the compact fluro tube on. This lamp gives out an amazing amount of light when compared to the tubes which are only 125mm long. Current consumption is about 1 amp. Size is 282(L) x 81(H) x 38(D)mm. Cat. ST-3010 **$32.95**

Replacement Tube Cat. ST-3011 **$6.95**

2D 16W SQUARE LIGHT

This unit uses the compact fluro tube called 2D, which is rated at 16 watts, which would be roughly equal to an 80 watt globe. It would be ideal to mount directly over a table, as it has a wide light dispersion. It also has a 3 position switch, with a 3 watt courtesy light included. Can be mounted either surface or recessed mount. Includes an electronic ballast. size is 160 x 160 x 45(D)mm. Current draw is 850mA. Cat. ST-3012

$42.95

Replacement Tube 2D 16W Cat. ST-3013 **$16.95**

PERSONAL ALARM

NEW

This personal alarm is small in size and can be used in different ways. To activate alarm simply pull the pin and it sounds this ear piercing, almost unbearable scream which will attract attention. The pin is attached to a lanyard with a plastic clip on the end which can be attached to keys, or belt loop etc. The alarm could be placed in a ladies handbag, with the lanyard around the hand. if the bag is snatched, the thief has an alarm sounding in the bag! Sure to catch attention. It has its own beltclip so it can be clipped to pants on a belt etc.

Size is 55(W) x 67(H) x 20(D)mm. and colour is black. Cat. LA-5180

Only $9.95

WATERPROOF HOODS FOR SWITCHES

NEW

These hoods simply screw over the toggle switch to prevent ingress of water.

2 SIZES AVAILABLE.

Small suits our mini toggle switches.

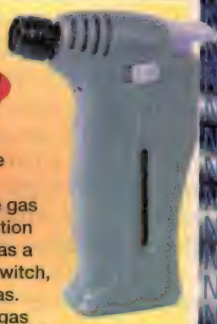
Large suits our normal size toggle switches.

SMALL Cat. ST-0590 **$1.25ea**

LARGE Cat. ST-0592 **$1.95ea**

MINI GAS TORCH

NEW



This torch replaces our old Pocke Torch.

This unit is gas fillable, rather cheaper than using a cigarette lighter. It's much cheaper to operate and holds much more gas than a lighter. It has piezo ignition and will ignite in the wind. It has a flame adjuster and an on/off switch, and is really easy to fill with gas. Height is 110mm. Use Jaycar gas (NA-1020 $5.95) Cat. TS-1682

Only $19.95

MAINS FILTER AND TELEPHONE PROTECTOR

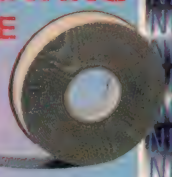
PROTECT YOUR FAX MODEM / CORDLESS PHONE ETC.

NEW

This unit is designed to protect both telephone line and AC mains from surges as a result of atmospheric disturbances, such as nearby lightning strikes. Protect computers, faxes, modems and phones. Includes gas arrestors for phone line and metal oxide varistors for mains.

Cat. MS-4025 **Only $32.95**

SELF AMALGAMATING ADHESIVE TAPE



This tape is an adhesive synthetic rubber and resin based tape that "cures" to a single mass once it is taped. Its ideal for sealing, waterproofing and insulating. Roll size is 20mm wide x 5mtrs. long. Black in colour.

NEW

Cat. NM-2825 **$14.95**

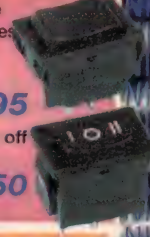
NEW SWITCHES

DPDT Mini toggle with centre off and spring return one way and on the other way.

Cat. ST-0510 NEW **$3.95**

DPDT Mini toggle with centre off & spring return both sides.

Cat. ST-0512 NEW **$3.95**



DPDT Large rocker with centre off and spring return both sides. These are commonly used for power car antennas.

Cat. SK-0980 NEW **$6.95**

DPDT Small rocker with centre off & spring return both sides.

Cat. SK-0987 NEW **$3.50**

NEW JAYCAR FAN

NEW

12V DC 120 x120 x 25mm. Specs. Air volume 80cfm Noise 42dB Speed 3000rpm Ball bearing. Cat. YX-2518

$27.50

LOW COST CAR AMP SELLOUT

18 WRMS per channel into 4Ω load. Cat. AA-0415

$32 Save $13

We have a very small amount of the 30 wrms per channel units.Cat. AA-0402 Was $75. Now $59

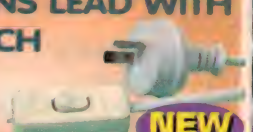
Not available at Dealers

JAYCAR OPENS IN NEW ZEALAND

As you read this, we are putting the finishing touches to our store in Auckland

14A Gillies Ave. Newmarket. Auckland.

2 CORE MAINS LEAD WITH INLINE SWITCH



Consists of a two pin 240V plug with an on/off switch in line. The cable is white and the length is 2.8mtrs. Terminates to bare ends.

NEW

Cat. PS-4120 **ONLY $7.95**

50Ω RG-58 C/U NETWORK CABLE

At last, its now available from Jaycar. The special RG58C/U cable that is used in computer networking. Cat. WB-2012

NEW

$1.20/m or $85/100m Roll

NOW OPEN - NEW QLD STORE - ASPLEY 1322 Gympie Rd, Cnr Albany Creek Rd.

MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

UNIVERSAL CROSSOVER PC BOARDS

NEW

BUILD YOUR OWN CROSSOVERS

These brand new 2 and 3 way crossover printed circuit boards have been designed as a versatile method of building your own customised crossover that will suit just about any speaker system. They can be used on 4 or 8 ohm speakers, and even with a combination of both. They can be wired to give a max. of 12dB per octave, or by leaving some components out, they could be 6dB or a combination of both. Full instructions on how to select the various components for different crossover frequencies are included, as well as an attenuation table for tweeters. Inductors & capacitors are available from Jaycar see 97 Cat P47 2 WAY Size: 122x122mm. 3 WAY Size: 140x195mm.

2 WAY PC BOARD
Cat. CX-2605 **$11.95 ea**

3 WAY PC BOARD
Cat. CX-2606 **$14.95 ea**

TV HEADPHONES WITH VOLUME CONTROL

NEW

Lightweight headphones especially suited to watching TV, and not disturbing others around you. Has inline volume control for left and right speaker, and long 5 mt. cord. Supplied with 3.5mm stereo plug & adaptor to 3.5mm mono plug. Freq range 20Hz - 20kHz; Impedance 32 Ω; Sensitivity 96dB at 1kHz; Max input power 100mw

Cat. AA-2005 **$9.95**

BATTERY CHARGER SENSATION

For November, buy our 8 x AA Fast Charger - At the catalogue price of $39.95 and receive free 8 x 800mA Nicads (Cat. SB-2450) worth $28.00!!

Buy This Cat. MB-3510 **Get These Free**

Only $39.95

OK SOLDER STATION

Buy in November at $199 and receive free 1Kg. roll of solder worth $24.95. Cat. NS-3002

Buy This Cat. TS-1620 **Get This Free**

Cat. NS-3002

Only $199

SAVE ON "MINI WAVE" TIPS

Tips for soldering SMTdevices by hand. They have a hollow section in the centre to hold solder. Not available at Dealers at these prices. Limited quantities.

TIPS FOR OK SA442	Cat. TS-1640
TIPS FOR HAKKO 926	Cat. TS-1642
TIPS FOR WELLER WTCP	Cat. TS-1644

Were $17.95ea. Now $12.95ea.

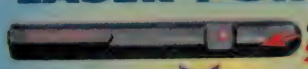
240V TO 115V AC STEPDOWN TRANSFORMERS

Allows you to operate American appliances on our mains power. Autotransformer construction. See 97 Cat. page 86 for full details.

250 WATT
Cat. MF-1094
Cat. Price $89.95
Nov. $79.95
Save $10

500 WATT
Cat. MF-1096
Cat. Price $119
Nov. $109
Save $10

LASER POINTERS

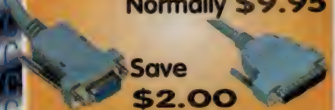


Cat. ST-3100 **$39**

KEYRING SAVE
Cat. ST-3102 **$45**

COMPUTER LEAD

D9 female to D25 male.
Cat. PL-0870



Normally $9.95
Save $2.00
Nov. $7.95

LARGE TAMPER RESIST TORX SCREWDRIVERS

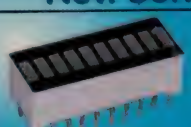
T25 size Cat. TD-2066 and T27 size. Cat. TD-2068
Normally $9.95ea
Save $3.00
Nov. $6.95

400 AMP CAR BATTERY CLIPS

The largest clips! Ideal for 300W and 500W invertors. Length 155mm. Sold in a pair 1 Red / 1 Black.
Cat. HM-3085
Was $9.95 pr
Nov. $6.95 pr
Save $3

LED BARGRAPHS

10 Red LEDS
Cat. ZD-1700
Was $5.50 **Nov. $3.95**



10 Red LEDS
Cat. ZD-1704
Was $4.95
Nov. $2.95

7 Green, 3 Red LEDS Cat. ZD-1706
Was $5.95 Nov. $3.95

MINI TOWER CASE

Includes 20W PSU. See 97 Cat. P161 for details.

Cat. XC-4635
Was $89.95
Nov. $74.95

CAR BATTERY DISCHARGE PROTECTOR

Cuts out when the car battery voltage goes below 11.2V, so you don't get a flat battery. Connects inline with item used, via cigarette lighter plug. Max. current 10A. Very limited quantity available. Not available at Dealers. Cat. AA-3095

Was $27.95 Now $20

CAR CELLULAR PHONE ANTENNA

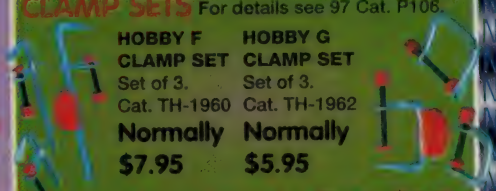
Sellout. Save over normal prices. Not available at Dealers. See 97 Cat. page 62 for details.
Cat. DC-4040
Was $39.95 Save $9.95
Now $30

MOTORBIKE ALARM

Remote control. remote start, engine kill, silent arming plus more. See 97 Cat. page 74 for details.
Cat. LA-8915
Save $80
Was $179.50
Nov. $99.50

CLAMP SETS

For details see 97 Cat. P106.



HOBBY F CLAMP SET	HOBBY G CLAMP SET
Set of 3.	Set of 3.
Cat. TH-1960	Cat. TH-1962
Normally $7.95	Normally $5.95

Nov. Buy Both For $10

EARPHONES WITH VOLUME CONTROL

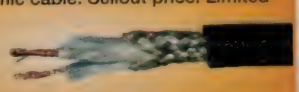
NEW

These earphones incorporate an anti-sound leak design and have a separate volume control for left & right speaker. Ideal for portable CD players, Hi Fi's, portable stereos, or other audio equipment. Using a 3.5mm stereo socket. Includes 2 free earpads. Frequency range 12Hz - 20kHz; Impedance 32Ω; Max input power 40mW; Cord length 1.2 mts; Plug 3.5mm gold stereo.

Cat. AA-2017 **$6.95**

"RODE " MIC CABLE

4 core hi-quality mic cable. Sellout price. Limited quantity. Not available from Dealers.



Cat. WB-1528
Was $2.95 metre
Nov. $2 metre

POCKET SHIFTER MULTITOOL

Includes •Shifter with 18mm jaw opening •Phillips head screw driver •Slotted screwdriver •File •Canopener •Bottle opener •Knife •Supplied with holder and belt clip •Made in Taiwan.

Cat. TH-1905 **Was $19.95** NOW HALF PRICE
November $10

MAXELL GOLD RECORDABLE CD'S

Best price in town? 74min, 680mB. Cat. XC-4710

Only $5.99

10+ $5.39

PCB MOUNT MINI TOGGLE

C & K brand

7103. SPDT Centre off, horizontal lever action, long activator (23mm). Cat. ST-0564

Were $1 each

Nov. 50c. or 10 for $4.00

HANDS FREE TELEPHONE HEADSET

These are a quality headset and microphone ideally suited for office situations where other people may be distracted by the two way conversation, or could be used on two way radios in vehicles.

See 97 Cat. page 52 for full details. Cat. AA-2018

Was $23.95

Save $9

Nov $14.95

Commander / PABX Phone Extension Leads

These have 6 wires instead of the usual 4.

3 metres Cat. YT-6016 **Was $15.95**

Now $9.95 **Save $6**

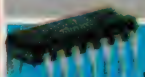
10 metres Cat. YT-6018 **Was $18.95**

Now $11.95 **Save $7**

15 metres Cat. YT-6019 **Was $22.95**

Now $14.95 **Save $8**

IC BARGAINS



	Was	Nov.	Cat.
4019 CMOS	$1.50	10 for $6	ZC-4019
4012	$0.80	10 for $2	ZC-4012
4015	$1.45	10 for $2.50	ZC-4015
4024 CMOS	$1.00	10 for $2	ZC-4024
4068 CMOS	$1.00	10 for $3	ZC-4068
74LS109	$1.25	10 for $2	ZS-5109
74LS175	$1.65	10 for $3	ZS-5175

UP-TO-DATE WORLD'S TRANSISTOR, DIODE, THYRISTOR & IC'S COMPARISON TABLES SELLOUT

See 97 Cat. page 190 for full details.

VOLUME 1 (ONLY 55 AVAILABLE) **BM-2480**

WAS $24.95 **NOW $20**

VOLUME 2 (ONLY 108 AVAILABLE) **BM-2482**

WAS $24.95 **NOW $18**

LOW COST MIDI BREAKOUT BOX KIT

See 97 Cat. page 10. Limited quantity. Cat. KA-1756

Was $13.95 **Save 3.95**

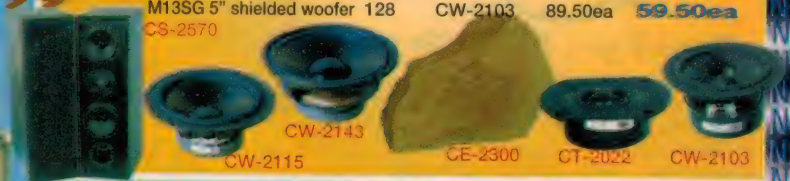
Sellout $10

OUR CANBERRA STORE HAS MOVED

NOW AT 121 WOLLONGONG ST FYSHWICK. ACT.

DISCONTINUED SPEAKERS AND KITS

DESCRIPTION	QTY.	CAT.	WAS $	NOW $
JV20 Vifa speaker kit	21ea	CS-2580	169.50ea	100ea
JV40 Vifa speaker kit	28pr	CS-2570	489.00pr	300pr
JV40 Cabinets	17pr	CS-2572	239.00pr	150pr
JV80 8" Woofer M22	46	CW-2115	199.50ea	120ea
JV80 8" Cabinet	36	CS-2540	139.00ea	69ea
JV110 10" Woofer M26	37	CS-2118	229.50ea	140ea
JV110 Cabinet less Baffle	23	CS-2552	149.00ea	90ea
JV110 Baffle	9	CS-2256	30.00ea	19ea
8" Black cone woofer	90	CW-2111	27.95ea	18ea
10" 8Ω Re/Sponse woofer	37	CW-2143	169.50ea	109.50ea
Pot plant speaker	32	CE-2305	99.00ea	69ea
Rock speaker	87	CE-2300	99.00ea	69.00ea
Vifa D25shielded tweeter	113	CT-2022	59.50ea	39.50ea
M13SG 5" shielded woofer	128	CW-2103	89.50ea	59.50ea



SELLOUT TEST EQUIPMENT!!!

RF SIGNAL GENERATOR

9 AVAIL Cat. QT-2312

Was $289

Save $100

Sellout Price $189

AC MILLIVOLT METER

32 AVAIL QT-2320

Was $269 Save $70

Sellout Price $199

TV PATTERN GENERATOR

23 AVAIL QT-2325

Was $299 Save $70

Sellout Price $229

RF SIGNAL GENERATOR

30 AVAILABLE Cat. QT-2302

Was $239

Save $60

Sellout Price $179

AUDIO GENERATOR

13 AVAILABLE Cat. QT-2310

Was $289

Save $100

Sellout Price $189

CD CASES

Pack of 5 Cat. AR-1470

Save $2

Was $5.95

Nov. $3.95

CD CLEANING PAD

Very limited quantity.

Cat. AR-1475

Was $4.95

Nov $2.95

Not available at Dealers

NEW SEMICONDUCTOR

MUR 1560 FAST RECOVERY DIODE

As required to increase current capacity of KC-5225 10A DC speed control kit Cat. ZR-1030

$5.95

NEW KITS

NEW

VIDEO ENHANCER AND STABILISER REFER EA NOV. 97.

Improve the quality of images from poor quality video tapes, and reduce degradation when you are making copies. Also includes circuitry which can give more stable viewing of video signals, by stripping out "piggyback" information like vertical - interval test signals and teletext data. The Jaycar kit includes box, punched & silk screened panels, transformer and all specified parts. Cat. KA-1798 **$69.95**

LINE CARRIER LINK

NEW

Refer EA Nov 97 This kit simply controls mains operated devices through 240V mains outlets without the trouble of messy wiring or infra red links. Great for home automation. Kit includes all quality electronic components, PCB, box with silk screened front panel.

Cat. KA-1799 **$69.95**

VIDEO DOORPHONE

NEW

See who is at your front door before opening it! You simply can't be too careful these days. When a visitor presses the doorbell, the video monitor automatically turns on, and you can see who is at the door. You can talk to them, and if you don't know them, ask them their business, without opening the front door. With the optional door release, you can remotely open the front door, and let the visitor in if you wish. The camera has IR LEDs for night illumination, and comes with installation hardware for flush or surface mounting. Supplied with clear instructions can easily be mounted by the family handy person. One year warranty.

DOOR RELEASE TO SUIT $34.95 Cat. QC-3415

Cat. QC-3410 **Only $469**

MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

"K" TYPE THERMOCOUPLE BARGAIN

Our suppliers sent us a shipment of these DMM temperature thermocouples without probe. Cat. QM-1283
Grab a spare Normally $12.95 (with probe)
THESE AREONLY $5EA ONLY 200 AVAIL.

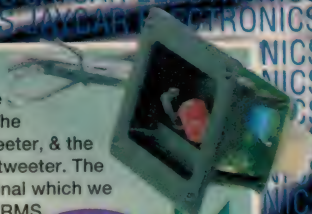
DOLBY PRO LOGIC SURROUND SOUND DECODER & EFFECTS UNIT KIT

See Cat. page 4 for details

DOLBY SURROUND PRO • LOGIC

KC-5200 Was $379
Nov. $299 Save $80

VIFA 2 WAY CROSSOVERS



Another surplus stock purchase. These have been designed for some old style Vifa kits. The SAX50 suited a 5" Vifa woofer and a D19 tweeter, & the SAX70 suited a Vifa 8" paper cone and D19 tweeter. The crossovers are mounted on a nice rear terminal which we sell for $5.25 alone. Both handle about 40 WRMS. Supplied with freq graph & schematic diagram. Limited quantity available.

NEW SAVE ABOUT $25

SAX50 CROSSOVER FREQUENCY 3 KHZ Cat. CX-2609
SAX70 CROSSOVER FREQUENCY 4 KHZ Cat. CX-2608

Only $14.95ea

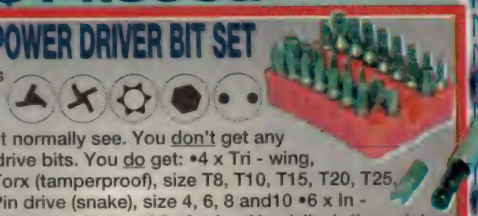
MAKE YOUR HOME LOOK ALARMED FOR $40

Most home burglar alarms have a siren and flashing strobe mounted in a metal box on the verandah, or under the front eaves. Burglars casing the street easily know who has an alarm, and who doesn't. Now you can make your home look alarmed with our new kit for a very low price.

SIREN COVER	**$29.95**
STROBE	**$19.95**
3 ALARM STICKERS	**$ 6.00**
NORMALLY	**$55.90**

Cat. LA-5130 Was $49
November $40 **Save $9**

"FULL HOUSE" POWER DRIVER BIT SET



All the weirdo driver bits in one go!! -The set consists of 32, of the driver bits that you don't normally see. You don't get any slotted, Phillips or Posidrive bits. You do get: •4 x Tri - wing, size 1, 2, 3, and 4 •9 x Torx (tamperproof), size T8, T10, T15, T20, T25, T27, T30 and T35 •4 x Pin drive (snake), size 4, 6, 8 and10 •6 x In - Hex (allen), *metric, size 2, 2.5, 3, 4, 5 and 6 •6 x In - Hex (allen), *imperial size 5/64", 3/32", 7/64", 1/8", 9/64" and 5/32" •3 x Torque Set, size 8, 9 and 10. With this you get a hex driver with magnetic retainer, all in a nifty plastic - rubber holder that is smaller than a deck of cards! (67 x 45 x 30mm), you will never get stopped by a wacko screw ever again!! SAVE $10

Cat. TD-2035 **Now Only $19.95**

MULTIMETER CASE

Made from black vinyl, and lined inside. It has 2 compartments. 175 x 95 to hold the multimeter and 175 x 23 for the leads. Divider can be removed.
Cat. QM-1365
Save $3.95
Was $8.95 **Nov. $5**

BUY 10 LESS 10%

SCOOP PURCHASE OF THE DECADE

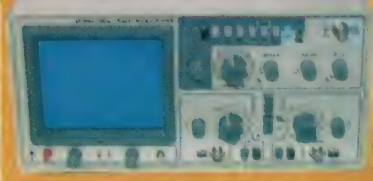
ALIRA INTERACTOR

Plug it into computer games, stereos etc, then put the back pack on and feel all the low frequency sounds. See previous ads for full details. Cat. XC-1000

SAVE $210!

WAS $249
THEN $49.95
NOVEMBER $39.95

25 MHZ DUAL TRACE CRO



Jaytech

Brand new model with 5" screen and suited to a wide range of applications. Features include a deflection coefficient of 5mv/div to 20V/div in 12 calibrated steps. It also gives algebraic ADD, SUBTRACT, INVERT & X-Y modes. The time base range is from 0.5µsec/div to 0.2 sec/div in 18 calibrated steps. A continously variable uncalibrated control between the steps, along with X5 expansion extends the fastest sweep speed to 40nS/div approx. Variable hold/off, in addition to multimode triggering, provides versatile triggering up to 40Mhz.

SUPPLIED WITH 2 PROBES. Cat. QC-1900 NEW **$699**

8MM CAMCORDER CLEANING KIT

Camcorder heads need to be kept clean. You can look after your valuable camera with this kit. Consists of: •Head clean tape • Head cleaning fluid •Lens cleaning fluid •Blower brush •50 sheets lintless cleaning sheets. Distress stock purchase. Normal retail price is around $24.95.

Cat. AR-1420
Was $9.95
November Only $5.00

TURN YOUR SURPLUS STOCK INTO CASH! Jaycar buys surplus/distress stock of most electronic products from components to built products. If you have marketable quantities of stock you need to clear contact Bruce Routley or Mark Ostro on Phone: 02 9743 5222 Fax: 02 9743 2066

Jaycar ELECTRONICS

HEAD OFFICE
8-10 LEEDS ST RHODES 2138
PHONE: (02) 9743 5222
FAX: (02) 9743 2066

Quality Endorsed Company ISO9002 Lic 6143 Standards Australia

WHOLESALE
PHONE: (02) 9743 5222
ORDERS: 1800 620 169
FAX: (02) 9743 3070
FREEFAX: 1800 810 137

MAIL ORDERS FREE POST TO:
Reply Paid 72. Jaycar Mail Orders. PO Box 185 Concord NSW 2137 FREE CALL FOR ORDERS: 1800 022 888
ENQUIRY HOTLINE: (02) 9743 6144 FAX: (02) 9743 2066

ROAD FREIGHT ANYWHERE IN AUST (up to 20kg) $14.00

POST & PACKING $10 to $24.99=$4.00 $25 to $49.99=$5 $50 to $99.99=$7 OVER $100=$8

bankcard Mastercard VISA Diners Club International AMERICAN EXPRESS eftpos

ADELAIDE SA	•194 Wright St (Cnr. Selby St) •Ph:(08) 8231 7355 •Fax:(08) 8231 7314 •Mon/Fri:9-5.30 •Fri:9-8.30 •Sat:9-4
BURANDA QLD	•144 Logan Rd •Ph:(07) 3393 0777 •Fax:(07) 3393 0045 •Mon/Fri:9-5.30 •Thurs:9-8.30 •Sat:9-4
ASPLEY QLD	•1322 Gympie Rd, cnr Albany Creek Rd •Ph:(07) 3863 0099 •Fax:(07) 3863 0182 •Mon/Fri:9-5.30 •Thurs:9-8.30 •Sat:9-4
CANBERRA ACT	•121 Wollongong Street, Fyshwick •Ph:(06) 239 1801 •Fax:(06) 239 1821 •Mon/Fri:9-5.30 •Sat:9-4
MELBOURNE CITY	•Shop 2,45 A'Beckett St •Ph:(03) 9663 2030 •Fax:9663 1198 •Mon/Fri:8.30-5.30 •Fri:8.30-8.30 •Sat:9-4 •Sun:10-4
COBURG VIC	•266 Sydney Rd •Ph:(03) 9384 1811 •Fax:(03) 9384 0061 •Mon/Fri:9-5.30pm •Fri:9-8.30 •Sat:9-4 •Sun:10-4
SPRINGVALE VIC	•887-889 Springvale Rd Mulgrave. Nr Cnr. Dandenong Rd •Ph:(03) 9547 1022 •Fax:(03) 9547 1046 •Mon/Fri:8.30-5.30 •Fri:8.30-8.30 •Sat:9-4 •Sun:10-4
HOBART TAS	•140 Campbell St, Hobart •Ph: (03) 6231 5877 •Fax:(03)6231 5876 •Mon/Thur:9-5.30 •Fri:9-7 •Sat:9-4
SYDNEY CITY	•129 York St •Ph:(02) 9267 1614 •Fax:(02) 9267 1951 •Mon/Fri:8.30-6 •Thurs:8.30-8.30 •Sat:9-4 •Sun:10-4
BANKSTOWN	•363 Hume Hwy Cnr Meredith •Ph:(02) 9709 2822 •Fax:(02)9709 2007 •Mon/Fri:9-5.30 •Thurs:9-8.30 •Sat:9-4 •Sun:10-4
GORE HILL	•188 Pacific Hwy Cnr. Bellevue Ave •Ph:(02) 9439 4799 •Fax:(02)9439 4895 •Mon/Fri:9-5.30 •Thurs:8.30 •Sat:9-4 •Sun:10-4
PARRAMATTA	•355 Church St (Cnr. Victoria Rd) •Ph:(02) 9683 3377 •Fax:(02) 9683 3628 •Mon/Fri:9-5.30 •Thurs:9-8.30 •Sat:9-4 •Sun:10-4
PENRITH	•199 High St •Ph:(047) 21 8337 •Fax:(047) 21 8935 •Mon/Fri:9-5.30 •Thurs:9-8.30 •Sat:9-4 •Sun:10-4
RHODES	•8-10 Leeds St •Ph:(02) 9743 5222 •Fax:(02) 9743 2066 •Mon/Fri:9-5.30
NEWCASTLE	•830 Hunter St. (Cnr Stewart Ave) •Ph:(049) 653 799 •Fax:(049) 653 796 •Mon/Fri:9-5.30 •Sat:9-4
PERTH	•326 Newcastle St Northbridge •Ph:(09) 328 8252 •Fax:(09) 328 8982 •Mon/Fri:9-5.30 •Thurs:9-7.00 •Sat:9-4

Construction project:

LINE CARRIER LINK FOR HOME AUTOMATION - 1

You can remotely control mains-powered devices in just about any part of your home or property, with this new Line Carrier Transmitter and Receiver setup. Using digital codes sent via the existing 240V AC wiring, the system can be used to activate mains appliances, lights, and even machinery from one central location. The units use conventional low-cost components, and their capabilities can be expanded to form the heart of a fully-blown home automation system.

by ROB EVANS

Back in the February 1997 issue of *Electronics Australia*, contributing writer Graeme Kelly presented an article titled 'Home automation: past, present and future'. This included quite a thorough overview of the rapidly evolving area of home automation — that is, using electronic signals to remotely control appliances around the home. With an estimated four million North American homes now equipped with home automation devices, Graeme noted the increasingly strong consumer interest in this field around the world, and how standards committees and equipment manufacturers have responded to that demand.

The result is a rapidly growing industry which produces home automation products based on several different hardware and software 'protocols'. These range from relatively simple codes sent though the house mains wiring, to complex two-way instruction signals that can be sent via a variety of paths — namely radio or infra-red links, plus dedicated coaxial, twisted-pair or 12V-line local area networks (LANs).

If you have the financial resources of Bill Gates for example, you can even have a full fibre-optic communication and home automation network added at the construction stage of your new house, as is the case with his recently completed $60 million high-tech home on the shores of Lake Washington, near Seattle. In Bill's vision at least, this is the way of the future...

Coming back down to earth though, the de-facto or starting point for virtually all of these systems is the long-established 'X-10' standard, which sends an (up to) 22-bit code via the house wiring, in bursts of 120kHz carrier. Each burst corresponds to a digital bit and is sent at the mains signal zero-crossing point, where the presence of a burst indicates a digital 1, and an absence equates to a digital 0. The bursts themselves have a duration of around 1ms, by the way, and tend to have a amplitude of about 5V.

The coding system itself appears to be divided into 'address' (8 bits) and 'command' (4 bits) sections, while the remaining bits provide 'framing' information plus room for added (enhanced) commands. From a practical point of view this means that the basic X-10 coding system can deal with up to 256 individual receiving units, and send a range of 16 different commands to each unit — more than enough to deal with even the most complicated home automation systems.

With this type of setup then, X-10 receiver units are used to control power to lights and appliances in various locations around your home, and one X-10 transmitter can then be used to control the action of all receivers, from one central location. Depending upon the complexity of your setup, the transmit-

ter itself can simply offer a set of 'remote' switches, be a fully programmable unit that sends commands at preset times, or for those who take their home automation very seriously, an interface for a personal computer.

As a system that communicates over the existing house wiring is clearly the most convenient and cost-effective way to install a home automation system in an existing building, this was the approach taken in our new Line Carrier Link project. In the interests of simplicity and cost, the transmitter unit offers just one set of control switches (ON and OFF) in its basic format, and can therefore send these two commands to a single receiver unit. The transmitter's capability *can* be upgraded fairly easily, however (more of this later), since our signal coding system allows for a generous number of receiver addresses and command instructions.

It's not X10

We should point out at this stage that we have used a much simpler coding system than that defined in the X-10 protocol, and this has a couple of distinct advantages for our Line Carrier Link system.

The first of these is that the simpler code significantly reduces the cost and complexity of the project, since the digital encoding and decoding process requires much less circuitry. This is particularly important if you only want to experiment with home automation at this stage, as the outlay for a full X-10 system would be very difficult to justify in a trial setup.

Secondly, our 'reduced instruction set' coding approach means that it takes considerably less time to transmit each command, so the system responds much faster than with an X-10 based setup. Since an X-10 network sends more than 20 bits of mains-synchronised data (one bit at each zero-crossing) with each command, *and* apparently sends each command twice, there is a considerable time lag between sending an X-10 instruction and the matching response from a receiver. This can be well over one second, in some circumstances.

Our line carrier command system uses an *eight-bit* coding system which is arranged with one start bit, four address bits and the remaining three bits assigned to function codes. This corresponds to 16 possible receiver addresses and eight function commands, and as in the X-10 format, the code bits are sent in a synchronous manner at each zero crossing point of the 50Hz mains signal.

As you can see from Fig.1, our system effectively sends two 100kHz bursts in each mains cycle, which means that a complete command code (eight bits) is sent in four 50Hz cycles — a transmit period of only 80ms.

In the example shown, the address code of '1010' will be decoded by the receiver unit assigned to that address (ten), and this in turn will decode the following command bits (111). This command (seven) will have a matching action in that receiver (say, '240V AC outlet ON'), which will be performed immediately.

So as you can see, the Line Carrier link's principle of operation is really quite straightforward, and while it has a reduced addressing ability when compared to the X-10 format, it should provide more than enough capabilities for a realistic home automation installation. Both the transmitter and receiver units can be upgraded to exploit the full potential of the coding system, even to the point of placing the whole system under the command of a PC — only very simple programming techniques would be needed for this, by the way.

Practical limitations

Like any communication system, a line carrier link will effectively have a usable range and a given capability to reject interference in the carrier medium. In this respect our prototype system performed well, and was able to cover the entire area of a typical house (including the ubiquitous back shed) with reliable results. And by the way, it can't really pass signals to another mains phase or communicate over very long runs of mains wiring, so there is little chance that the signals will interfere with any similar system in your neighbour's house.

Other than that, we did find that one older model television — which featured a fairly primitive switchmode power supply — tended to flood the house mains wiring with 110kHz interference, thereby crippling the line carrier link setup. We strongly suspect that this extremely 'noisy' set would also paralyze a commercial X-10 based system, and is most likely an isolated case.

The matching Line Carrier Receiver features just two status LEDs, and a set of 240VAC input/output cables. Up to sixteen of these can be individually controlled by one central transmitter unit.

We also performed a number of checks using a couple of computer systems as our testing noise source, and found that the mains interference generated by these notoriously noisy devices didn't degrade the link's performance in any way. Ironically though, a mains line filter unit (typically used with computer systems) may in fact diminish the link's performance, since the internal filter components of some models tend to load the mains wiring at high frequencies.

All in all though, the system worked well, and it was interesting to note that when viewed on an oscilloscope, the mains waveform has the least evidence of interference signals at its zero crossing points — exactly where our 100kHz code bursts occur. This is probably due to the fact that any device that generates interference will tend to do this when

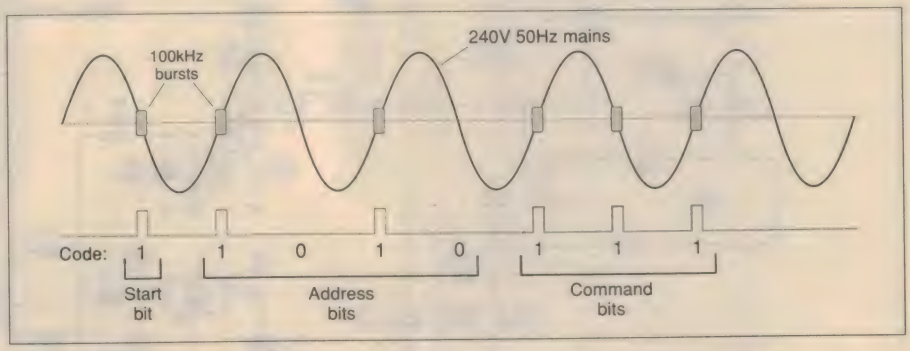


Fig.1: The system uses an eight-bit command 'byte' to send instructions through the existing mains wiring, with each 100kHz code burst aligned to the mains zero-crossing point.

the mains waveform has reached a reasonable voltage level, where there is sufficient energy for the device's internal circuitry to begin taking effect. A PC's monitor screen is a prime example of this, and will often generate large interference bursts in the rising edge of the mains cycle.

So there you have it. A reliable digital link for home automation that uses the existing infrastructure, rather than an expensive purpose-installed signal wiring system. It's quite inexpensive to build and can be used for a extremely wide range of applications — in fact, its uses are only limited by your imagination.

Transmitter circuit

The line carrier transmitter circuit can be split into three general areas: the timing section based on Q1 and counter IC2, the code generator stage formed by shift register IC1, and the actual 100kHz transmitter stage based on IC4 and Q2 — see the schematic shown in Fig.2.

Starting with the timing source, the 240V AC mains supply is applied to power transformer T1, which has its 30V centre-tapped output full-wave rectified by diodes D6 and D7. The rectified AC is then applied to reservoir capacitor C8 via isolating diode D5, resulting in a raw DC supply of around 20V. This is turn feeds three-terminal regulator IC5, producing the circuit's regulated 5V rail across bypass capacitor C7.

The rectified signal at the cathodes of D6 and D7 is also applied to a simple 'master clock' circuit based on Q1, via limiting resistor R9. Here, the voltage divider action of R9 and R10 means that Q1 will be off when the input waveform drops below about 1.2 volts, and otherwise fully saturated. C6 helps to filter out any high-frequency signals passed from the mains supply, by the way.

Q1 will therefore briefly turn off at each mains zero-crossing point (since the rectified input waveform falls to zero at this time), resulting a series of short negative-going pulses at its collector. These 100Hz clock pulses at pullup resistor R8 are then inverted by NOR gate IC3b and applied to the code-generating shift register IC1, plus the circuit timing counter IC2.

IC2 is normally held in a reset state by pullup resistor R2, which holds the 4040's reset input at a high level, until it's pulled low as (say) the 'OFF' command button PB1 is pressed — to send an OFF signal to a remote receiver unit. IC2 then counts 100Hz clock pulses (via pin 10) while the button is held, producing a 6.25Hz output at its Q4 output (pin 3).

The Q4 output is used to repeatedly trigger the transmitter while the button is held, which ultimately causes the code (in this case corresponding to 'OFF') to be re-sent every 160ms. Note that while the trigger signal at Q4 goes to a high level every 160ms, the *first* high will arrive after a delay of 80ms. The button therefore needs to be held for longer than this period before the unit will transmit a code.

To start the code generating process, the 'repeat' clock at IC2's Q4 output is applied to IC1's parallel-load input (pin 9) via a differentiating circuit based on C1, R1 and D1. This produces a positive-going spike at each rising edge of the repeat clock, which in turn forces shift register IC1 to load in the logic levels appearing at its parallel-load inputs, P0 to P7.

These logic levels directly reflect the control code that will be sent, and in the case shown in the transmitter's schematic (Fig.2), this corresponds to a digital code of 110101X1. Note that the 'X' is the level presented by NOR gate IC3c, and the transmitting bit order is P7 through to P0.

If we consider that logic level X is zero at this stage — which corresponds to an OFF code — a total code of 11010111 will then be clocked out of the shift register (at pin 3), in sympathy with the 100Hz pulses at its clock input (pin 10). Since the register's data input (pin 11) is tied low, the above code will be followed by a series of zeros until the repeat/trigger clock at pin 9 restarts the process.

Returning to the ON/OFF pushbuttons (PB1 and PB2) for the moment, you can see that a different action will occur if the ON button is pushed rather than the OFF. Here, the switch pullup resistor R3 is coupled to NOR gate IC3c, and this in turn will apply a *high*

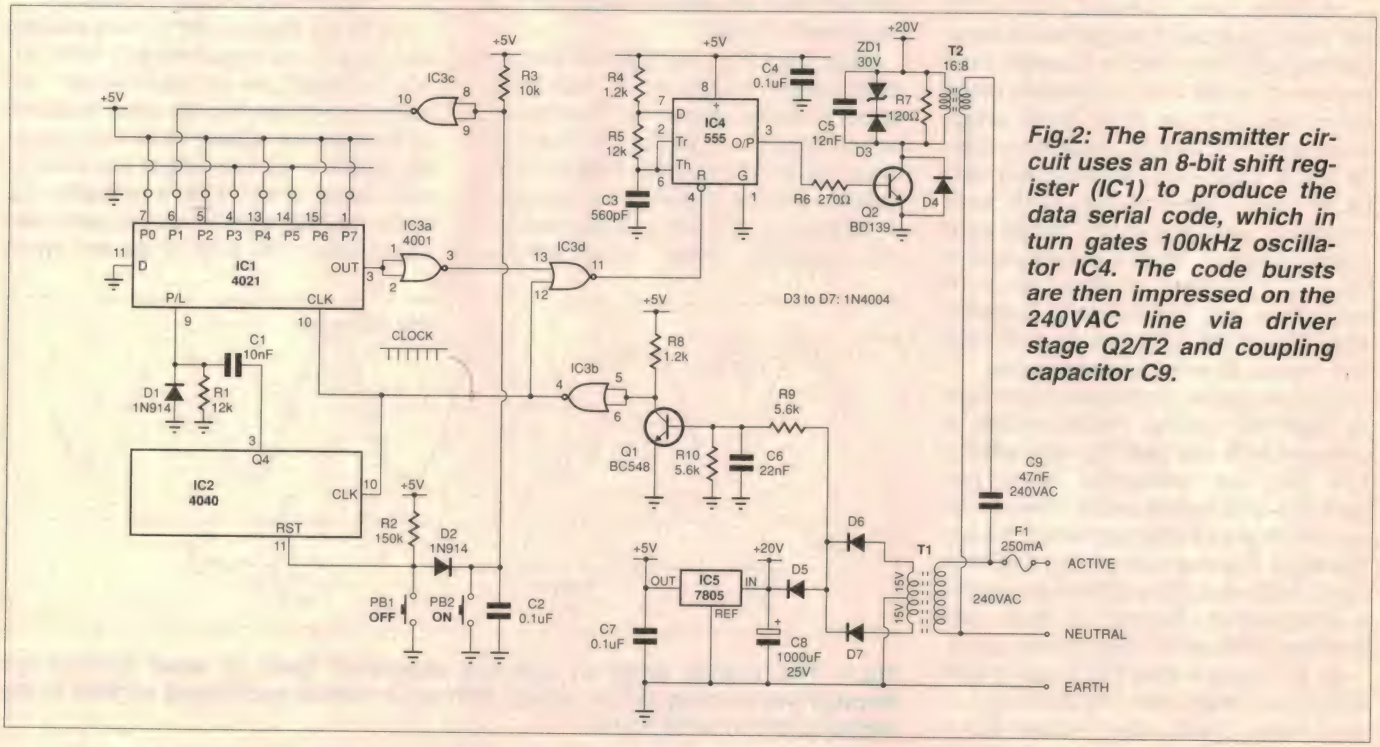


Fig.2: The Transmitter circuit uses an 8-bit shift register (IC1) to produce the data serial code, which in turn gates 100kHz oscillator IC4. The code bursts are then impressed on the 240VAC line via driver stage Q2/T2 and coupling capacitor C9.

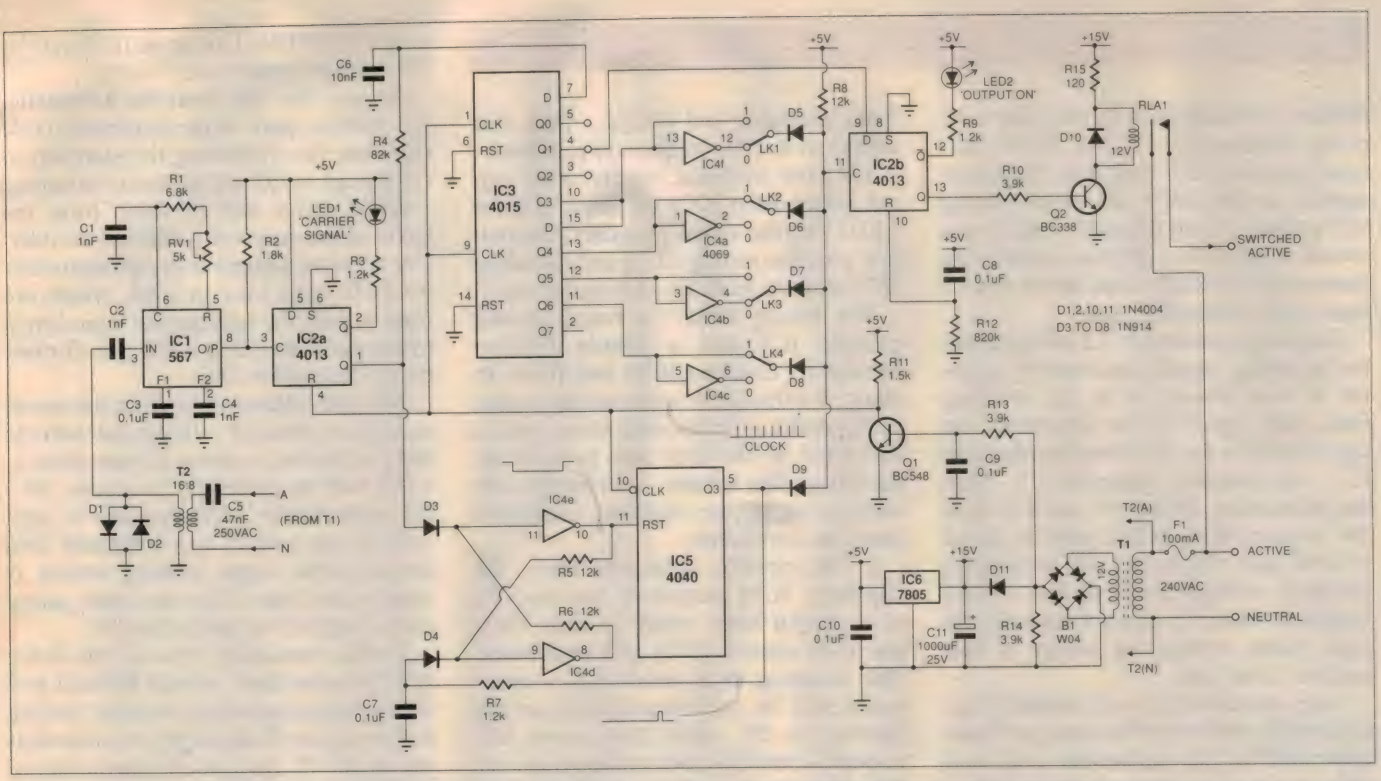


Fig.3: The Receiver circuit detects 100kHz code bursts on the mains with IC1 (via T2 and C5), then uses shift register IC3 plus a simple AND gate (D5 to D9) to extract the 8-bit command code.

level to the shift register's P1 input, as the ON button is pushed. The above-mentioned logic bit X is now at a high level, so that the total code sent corresponds to an ON command: 11010111.

Note that in this case D2 will couple the low level at PB2 to IC2's reset input, so the repeat trigger circuit will still be activated as detailed above. Also, the charging action of C2 will cause the X bit (at P1 of IC1) to briefly hold its high value *after* the button has been released, so that the ON code remains valid during the 80ms transmit time.

The shift register's final output at pin 3 is inverted by NOR gate IC3a, and applied to pulse shaping NOR gate IC3d. Here, the negative-going master clock pulses are gated with the inverted serial code from IC1 to produce brief positive pulses with each logic 1 level in the transmit code. These will have a duration of around 2ms, as set by the width of the master clock pulses.

As you can see from the schematic, the code pulses are then applied directly to the reset line (pin 4) of the transmit oscillator IC4, a 555 timer chip. This is arranged in a standard astable configuration with components R4, R5 and C3 setting the free-running frequency to around 100kHz, and will be enabled with each positive pulse in the transmit code stream applied at pin 4.

The resulting 100kHz code bursts at IC4's output (pin 3) are then coupled to the output stage driving transistor Q2 via limiting resistor R6. Q2 in turn drives the line-output coupling transformer T2, which is broadly tuned to the carrier frequency by C5 and damped by resistor R7.

The transformer primary winding's back-swing voltage is restricted to around 30V by the combination of ZD1 and D3, and is clamped across Q2 by D4. T2 has a turns ratio of about 2:1 (16 primary, eight secondary turns), and the low impedance 100kHz energy at its secondary is coupled back into the 240V AC line via mains-rated capacitor C9.

So we now have a coded series of 100kHz bursts impressed on the 240V AC mains, each time the transmitter's command buttons are pressed. The bursts are synchronised to the mains zero-crossing points, have a duration of around 2ms — and depending on the mains 'impedance' at the time, will have a peak amplitude of about 5V. Also, the bursts are sent in code groups of eight over an 80ms period, with the groups repeating every 160ms if the transmitter button is held.

Receiver circuit

The line carrier receiver unit's schematic is shown in Fig.3, and as you can see it's a little more involved than the transmitter. In this case, signals are synchronised by clock generator Q1, timing is performed by counter IC5, and the signal information is decoded by shift register IC3. In addition, a 567 tone decoder (IC1) is used as a receiver 'front end', while dual D-flipflop IC2 is used to shape the input signal and also latch the decoded commands.

Starting with the main timing circuits as before, power transformer T1's 12V AC secondary voltage is rectified by full-wave bridge B1, then passed to the DC supply stage via isolating diode D11. The resulting 15V DC supply across reservoir capacitor C11 supplies the three-terminal regulator IC6, which in turn generates the circuit's main +5V supply at bypass capacitor C10.

As before, the 100Hz signal at the rectifier output is passed to transistor Q1 via an RC coupling network, which in this case is formed by R14, R13 and C9. With this network arrangement R14 ensures that the source waveform fully drops to zero at each zero-crossing point, while R13 simply acts as a limiting resistor for the base of Q1. Again, capacitor C9 removes any high-frequency signals passed from the mains.

With this clock circuit Q1 will be conducting until the rectified input waveform drops below about 0.6V, which results in clock pulses of less than 1ms duration at Q1's load resistor R11. These 100Hz positive-going pulses are then applied to the main timing counter IC5, plus the signal pulse shaping flipflop IC2a.

Returning to the mains power transformer T1 for a moment, you can see that connections T2(A) and T2(N) at its

primary winding pass to the line coupling transformer T2, via 250V AC-rated capacitor C5. Any high frequency signals on the 240V AC mains wiring will pass to T2 via this path, and as you would expect this will also include the (now small) 100kHz code bursts from a line carrier transmitter unit.

Coupling transformer T2 will increase the incoming signal amplitude by a factor of two, thanks to its 2:1 winding ratio, and signals at its secondary are then passed to the 567 tone decoder chip IC1, via coupling capacitor C5. Note that protection diodes D1 and D2 limit the voltage swing at this point to about +/-0.6V, and play a vital role in clipping the large voltage transient that can be produced when C5 charges towards the peak mains voltage, as power is first applied to the unit.

Tone decoder IC1 is set to detect signals which match the frequency of those generated by the transmitter unit, and will generate a low level at its output (pin 8) in response to the correct incoming 'tone'. The 567's free-running frequency, and therefore its effective tuning, is determined by components C1, R1 and RV1, while its detection response is set by filtering capacitors C3 and C4. In practice, RV1 is simply tuned to match the transmitter's frequency, which is preset to around 100kHz by fixed component values.

Next, the output from IC1 is applied directly to the clock input of flipflop IC2a, with R2 acting as a pullup resistor for the open-collector output of IC1. Negative-going pulses at this point will correspond to 100kHz code signals from the line, and the trailing (that is, rising) edge of each pulse effectively *sets* the D-flipflop, since the high at its D input is clocked to the output.

The flipflop remains in this state until it's reset by the next master clock pulse arriving from Q1, several milliseconds later. With this arrangement, the signal pulse from IC1 now has its trailing edge synchronised to the mains-derived clock signal, and can now be processed in a synchronous fashion by the remaining circuitry.

Note that this signal 're-processing' is necessary because while the transmitter produces each code pulse at the mains zero-crossing point, they generally arrive at a distant receiver in a reduced and *delayed* form. This effect appears to be a result of the low-pass filtering action of the mains wiring, which as you would imagine forms a filter network, which both attenuates and delays signals that are not in its (low frequency) passband.

The now extended, synchronised signal pulses from IC2a are used to drive LED1 ('carrier signal') via the Q-bar output, plus the timing (IC5) and decoding (IC3) circuits from the Q output at pin 1.

The timing circuit is based around counter IC5 and a simple flipflop formed by inverters IC4e and IC4d. In short, it effectively operates as a non-retriggerable, synchronous timer, and is instigated by the first code pulse of an incoming data stream — in reality, the *start* pulse of the eight-bit command from the transmitter.

In the circuit's quiescent state, the flipflop's IC4d output is low and its IC4e output high, which in turn holds the 4040 counter (IC5) in a reset state. The incoming high level from a command start bit will immediately *set* the flipflop via D3, which then allows IC5 to begin counting clock pulses at pin 10. Note that thanks to D3, subsequent data pulses will be ignored by the flipflop — its non-retriggerable aspect.

After eight clock pulses the counter's Q3 output (pin 5) will then go to a high level, which resets the flipflop at D4, via the delay network based on R7 and D7. As the flipflop's reset state will also reset the counter, the delay introduced into the reset line allows the counter's Q4 output to stay at a high level for a significant time period.

The timing circuit therefore produces a brief positive-going pulse which occurs eight clock cycles (80ms) after the incoming command's start bit. This corresponds to the end of the eight-bit command transmission time, and is used as a code 'gating' pulse in the decoder section based on IC3.

Turning now to the data decoding section, you can see that the processed data stream from IC2a is passed to the 4015 shift register (IC3) data input (pin 7) via delay circuit R4/C6. The 4015 is in fact two four-bit shift registers, by the way, and these have been wired in series to form an eight-bit register in order to match our eight-bit code structure. Note that pin 10 is linked to pin 15, and the clock inputs (pins 1 and 9) are tied together.

Since the 4015 is clocked at the same rate as the incoming stream of data pulses, the actual data code will ultimately appear in a parallel format at the register's outputs, after eight clock cycles. If the code is say the ON command used in the transmitter circuit explanation above, we would therefore expect a code of 11010111 to be at IC3's Q7 to Q0 outputs at this time.

As you can see from the schematic, the *address* part of the command code (the four bits following the start bit) at Q6 though to Q3 are applied to inverting gates IC4a,b,c and f, which form the basis of the receiver's address decoder. The receiver address is pre-programmed by PCB links LK1 to LK4, which are used to pass the appropriate logic levels to the main decoding AND gate formed by D5 through to D9.

With the address code from the above example (Q6 to Q3 = 1010) and with the links as shown, a series of ones (that is, +5V) will be presented to diodes D8 - D5 respectively. Note that this is only valid at the *end* of the command data stream (after eight clocks), which is exactly the time when the code gating pulse from IC5 is applied to D9.

As this remaining input of the diode AND is now high, resistor R8 will pull IC2b's clock input high, thereby forcing the level at its D input (pin 9) to the output at pin 13. As you can see however, the D input is tied back to the Q1 of IC3.

Since IC3's Q0 to Q2 outputs represent the data (rather than address) section of the processed command byte, these will have a code of 111 in our ON command example. A logic one is therefore being applied to IC2b's D input, and this is consequently passed to the output by the 'address valid' pulse at the output of the diode AND gate, as mentioned above. The received ON command has therefore *set* the output latch IC2b.

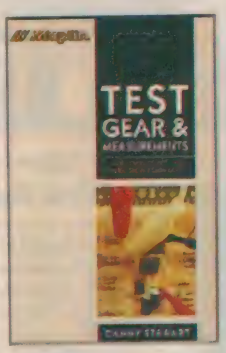
Virtually the same chain of events will apply when an OFF command is received. In this case though, the code of 11010101 will hold Q1 of IC3 at a low level, which will be duly clocked through to the output of IC2b. The OFF command therefore *resets* the output latch.

This final output at pin 13 of IC2b (Q) is then used to drive the 240V AC mains-switching relay RLA1, via limiting resistor R10 and driver transistor Q2. Here R15 reduces the voltage across the relay coil to around 12V, D10 quells the back EMF from the relay coil, and the LED2/R9 combination driven by IC2b's Q-bar output are used to provide a visual indication of the unit's output state. And finally, the C8/R12 combination provides a power-on reset pulse for the output latch.

That's all we really have space for in this issue. In our next instalment, we'll discuss building the transmitter and receiver modules, and their setting up and use. We'll also look at how the system can be expanded into a much more elaborate home automation system. ❖

NEW BOOKS

Testing, testing



TEST GEAR & MEASUREMENTS, by Danny Stewart. Published by Butterworth-Heinemann (Newnes imprint), 1996. Soft covers, 214 x 136mm, 166 pages. ISBN 0-7506-2601-1. RRP $29.

This is one of a series of books developed in conjunction with very successful British electronics supplier Maplin Electronics. It's based on a series of articles originally published in Maplin's publication *Electronics, The Maplin Magazine*.

As the main title suggests, the book provides a basic introduction or 'first guide' to test instruments and their operation — although the subtitle on the front cover seems somewhat at odds with this, claiming that it's 'A collection of useful and tested circuit design ideas'. There *are* a few circuit ideas included, but that's really not the main emphasis.

It's a slim little volume, with a relatively modest amount of text and illustrations, but there's still quite a bit of useful and down to earth information on measurement basics and the operation of common instruments like multimeters and bridges. The material on more complex instruments like signal generators and oscilloscopes is fairly sketchy, though, and will probably do little more than whet the reader's appetite for more.

For those looking for an accessible introduction to test and measurement, it would be well worth considering.

The review copy came from Butterworth-Heinemann Australia, of PO Box 146, Port Melbourne 3207. (J.R.)

DIY music projects

PRACTICAL ELECTRONIC MUSIC PROJECTS, by R.A. Penfold. Published by Bernard Babani (publishing) Ltd, 1994. Soft cover, 180 x 210mm, 122 pages. ISBN 0-85934-363-4. RRP $13.95.

This little book recognises the popularity of construction projects related to music. It presents a range of these projects, which, according to the author, do not need test equipment to set them up correctly.

It's divided into three sections: guitar projects, miscellaneous music projects and MIDI projects. In each case there's a parts list and circuit, along with details on construction. However there are no PCB patterns provided, so you either design your own board, or build the circuits on strip board.

The section on MIDI circuits is the largest, and starts with a simple MIDI tester, followed by a MIDI comparator that can detect the presence of a particular MIDI message. This circuit would be difficult to build on strip board, as it uses a number of complex ICs. Other circuits include a simple MIDI thru box, a noise gate (to isolate the signal when it falls below a certain level), a MIDI control pedal based on a 6402 UART, a MIDI lead tester and a regulated 9V DC power supply.

The review copy came from Jaycar Electronics, and it's available from Jaycar stores as Cat. No. BM7040. (P.P.) ❖

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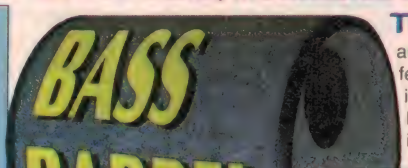

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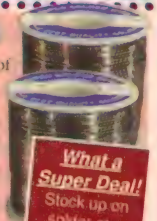

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C 3100 Normally $99, NOW JUST **$65**

Vented enclosure details supplied FREE on request!

24VDC to 13.8VDC Converter

Converts 24V DC to 13.8V DC at up to **5 Amps** for use with stereos, CB & Two-Way radios, or equipment designed to operate in a vehicle. Suitable for vehicles such as trucks, tractors, and some 4WDs which are fitted with a 24V battery system. Features overload protection and fused output with a rugged extruded aluminium case.

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Use 12V equipment in trucks or tractors with 24V battery systems!

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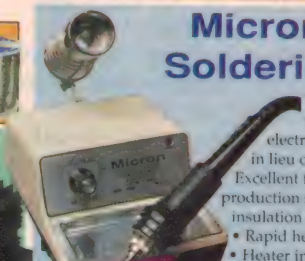

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Our previous autoranging DMM sold for $119, in our opinion this new model is far better, and right now it's $50 cheaper!

Features: • 3.75 digit LCD with a digital bargraph display • autoranging with manual override • display hold function • audibly continuity buzzer • diode check • up to a huge **15A** current measuring capacity • auto DC/AC detect with manual override • fuse protection • **supplied complete with a shock-proof rubber holster and flexible test leads!**

Specifications:
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DC/AC Current: 320µA, 3200µA, 32mA, 320mA, 15A
Resistance: 320Ω, 3.2k, 32k, 320k, 3.2M, 320M

Fantastic Value! 3.75 digit DMM with bargraph and autoranging! Includes rubber holster and test leads!

Q 1072 Normally $99, **NOW $69**

PC FM Radio Receiver

AS FEATURED IN SILICON CHIP MAY '97 PRODUCT SHOWCASE!

Turn Your PC into a FM Radio! Simple "Plug-In" installation.

A plug-and-play FM broadcast band receiver for your multimedia PC! Plugs into the RS-232 serial port (DB25), and has an audio output which connects to your PC's sound card. The Windows-based tuner program includes presettable memories for your favourite stations, seek tuning and even a frequency display! Once tuned, the radio will operate in the background while you use the computer for other tasks. The software can be closed while the radio continues playing, saving RAM. Package includes radio module, stereo 3.5mm jack audio lead, antenna and software. No external power required, covers 87.5MHz to 108MHz FM band. 40mV rms output at 60dB S/N ratio. Requires 386SX or better CPU, sound card and Windows 3.1/'95 OS.

A 0900 Normally $49, **NOW $39**

Includes Windows Based Control Software!

NiCad Rechargeable Batteries

With Christmas coming up, chances are you'll be paying out for batteries to power the presents! These NiCad rechargeable cells will eventually pay for themselves, and can provide hundreds of recharges if cycled periodically (see our A 0280). They can be used in just about any battery powered appliance.

S 4705 700mAh AA Cell Normally $2.30 ea,
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NOW **$4** ea, 4 and up, or **$3.50** ea, 10 & up

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High Quality MINAMOTO brand! Get up to 1000 recharges or more! Australia's LOWEST prices!

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Internal regulator provides precise voltage output and smooth DC for sensitive devices!

Mini Toggle Switches

WHAT A BARGAIN! Stock up on these high quality SPDT mini toggle switches. As used by manufacturers Australia-wide, and in many of our own kit sets and products. Rated at 5A @ 125VAC or 28VDC.

Save 30% in packs of 10!

S 1310 Normally $2.15 ea, **NOW $15** pk 10

Keychain Laser Pointer

This laser pointer weighs only 45g, and comes with a keychain. Measuring only 61mm long by 14mm in diameter, it's not much bigger than many keys! It emits a very intense beam that can travel up to 50m, and projects a bright red dot onto the target is it aimed at. It's ideal for lectures, guided tours, seminars, building sites etc, and it's much less intrusive than a normal stick pointer! Uses two button batteries (included).

Great for tours, lectures, seminars etc!

A 0201 WAS $69, **NOW $59**

Battery Charger & Refresher

Charges or discharges Nickel Cadmium and Nickel Metal-Hydride cells, and refreshes up to four carbon or alkaline cells, or up to two 3V lithium cells. Accepts AA and AAA sizes of all capacities. Features LED charging status and cell type indicators. Discharger operates at the push of a button, and if used to "cycle" batteries regularly, it can reduce memory effects in rechargeable cells, giving longer service life. Powered by 12V DC, either from M 9664 plug pack (not included) or car battery.

Keep your rechargeables in top condition and extend their service life! Also includes Alkaline Refresh Function.

A 0280 $39.95
M 9106 12V 500mA Plug Pack **$22.95**

High Power Siren

Strong & durable construction, makes this siren ideal for car, boat or home installation. Includes a handy bracket for surface mounting. **Extremely loud 120dB output.** Requires 12V DC @ 300mA. Dimensions 100Ω x 125L mm.

S 6130 Was $30.95,
NOW **$19.95**

Massive 120dB Output! Great for car & house security systems or alarm panels!

Professional 5 Sector Digital Alarm System *with Auto Dialler*

This system is the same type used by commercial alarm companies to protect both residential and business premises across Australia.

Improve the security of your home or business with this micro-processor controlled alarm, & get $100 worth of accessories FREE!!

Incorporating an inbuilt ***Austel approved*** auto-dialler, this alarm can be configured to automatically dial two preset numbers in the event of an alarm, i.e. it could ring a neighbour or a monitoring company. The main controller circuitry is housed in a sturdy steel cabinet, which can house an optional back up battery if required. The keypad control unit is generally located at the front door for easy access to arming and disarming of the system. The entire system is controlled and programmed via this keypad. A combination of normally open and normally closed sensors can be used on any zone. **Features:** • master code and three adjustable user codes • monitor function which tests battery backup and mains failure • four sectors with programmable attributes plus 24Hr zone • extensive noise protection circuitry and end of line resistors for added security • once triggered the alarm has the option of a silent alarm plus dialout • quick arming option • zone bypassing for sectors which are false triggering • bell test - to test the external sirens without dialling out • door chime mode for entry/exit paths • battery backup • home or away operation • accessible alarm memory for confirming which sectors were triggered • separate instruction and installation manuals • 12 months warranty

S 5490 $279

Pocket Size DMM

This mini DMM has test leads which are hard wired to the unit and slot into an integral clip on the side of the unit. No more lost test leads! Features 3.5 digit display, auto power off, battery check and diode test function. Just the shot for the student lab kit or enthusiast toolkit! **Ranges:**
DC V: 2V, 20V, 200V, 500V
AC V: 200V, 500V
Resistance: 2k, 20k, 200k, 2M
DC A: 200mA (Fused)
Hfe: 0 - 1000, **Batt. check:** 1.5V and 9V

Q 1030 Normally $29.95
NOW ONLY **$14.95**

YES! A 15 Range DMM for UNDER $15! But Be Quick! They're going ***FAST!***

Pulse Count PIR Detector

Buy a set of 4 & SAVE!

Incorporates a pulse count circuit to minimise false triggering, "sense" LED, tamper switch and relay output. Range up to 12m horizontal when mounted 2m from the floor, with a 90° detection angle. Coverage can be changed by sliding the PCB up or down in the case. Can be configured as Normally Open or Normally Closed with . Suits the S 5490 alarm or many other security systems.

S 5315 Was $49, **NOW $39**, or Buy 4 for **$140**

6 Core Security Cable

W 2356 $1.30 per metre
or **$170** 200m Roll

NB: 200m is enough to wire an average four bedroom home

Siren Cover

S 5460 $28.95 ea

Super Bonus Deal!

Purchase a S 5490 5 Sector Alarm system before October 31st. and we'll supply ***$100*** worth of accessories ***FREE!!!***

Bonus package includes M 9127 Plugpack, S 5075 Backup battery, S 6130 Siren, S 5445 Blue Strobe, 2 Large alarm stickers and 4 window stickers!

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ALTRONICS COMPONENTS

ALTRONICS Order Line: (08) 9328 3487

5 Digit Tacho Kit

NEW!

At last! A useful digital tacho with super-fast update time and 1 rpm resolution!

(See EA Oct '97) A fantastic, high-tech addition to your car's dashboard. This 5 digit tachometer features a crystal timebase for super-accurate readings, a 0.25 second update time and a resolution of ONE rpm. It also has a dimmable display, leading zero blanking, last digit "0" lock (stops "rolling" display), and can read to 60,000rpm if required. Not even rotaries rev *that* high! Can be configured for ignition coil input (3V) or low level input (1V) from an existing tacho. If you're after a *useable* digital tacho for street or circuit applications, this is it! *Note: Case NOT included.*

K 4325 **$79**

Multi-Spark Capacitor Discharge Ignition Kit

NEW!

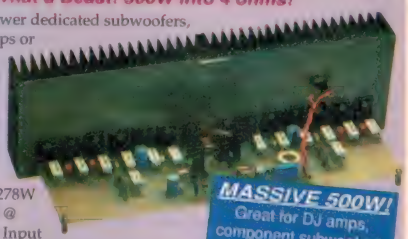
Provides multiple sparks for a cleaner, extended mixture burn, increasing power and efficiency!

(See SC Sept '97) Why multi-spark? Fuel burns more thoroughly with a multiple spark and can therefore improve engine performance especially in two stroke motors, older engines and high performance four strokes. The circuit also fires fouled plugs, thereby reducing the time between plug replacement. If you own a go-kart, why not boost it's performance with this circuit? • Operates on reluctor, points or hall effect signals • Regulated 300V output (constant spark energy) • Twin inputs for twin coil systems • Output for electronic tachometers • Usable to beyond 1000 sparks/second (equals 15000 rpm for V8) • Includes all parts except the pickup circuit. • Supplied in an attractive black powder coated metal automotive project box.

K 4370 **$110**

500W Amplifier Module Kit

(See SC Aug '97) ***What a Beast! 500W into 4 ohms!***



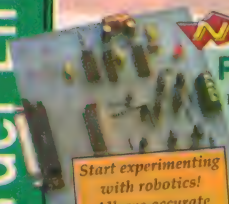
MASSIVE 500W! Great for DJ amps, component subwoofers, instrument amplifiers, even PA systems!

Just the thing to power dedicated subwoofers, DJ, PA or party amps or the like. Silicon Chip claims it's the biggest amplifier ever published in a magazine and they'd be right. *Features* • 500W RMS into 4 ohms , 278W into 8 ohms (-0.3dB @ 20hz and 20KHz) • Input sensitivity 1.43V (at full power into 8 ohms) • Distortion typical less than 0.01% • Signal to noise 117db un-weighted 122db A-weighted • Supplied with the PCB and the components to populate the board, requires a heatsink and power supply *(requires ±80V DC)*

K 5190 **$230**

PC Stepper Motor Controller

NEW!

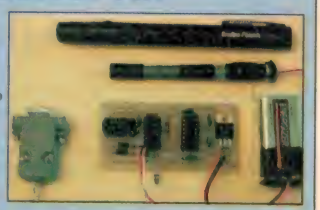


Start experimenting with robotics! Allows accurate control over a stepper motor.

This kit allows control over a single stepper motor via the parallel port of a PC computer. Uses include control of robot projects or any other application where a precise number of turns or revolutions is required (with a little imagination and experimentation maybe a turns winder for transformers). Daisy chained together, control of up to eight motors is possible with one PC. Supplied in short form and requiring a 12V DC power supply this project comes with all the components and PCB to begin experimentation.

K 2835 **$32.50**

Laser Transceiver Kit



(See EA, Aug '97) Utilising a MAX232 IC and a clever little circuit to strobe the laser and interpret the received signal, this kit allows two computers to communicate over distances of up to 50m or more (depending on the laser used) via their RS232 ports. Supplied shortform with the components to build the transceiver.

Laser pointer extra, see our A 0201, this month only $59

K 2860 **$21.95**

Laser Transmitter Kit

(See EA, Aug '97) The transmitter can be used for light effects, one way (half duplex) communication with the PC and experimentation. With RS232 input and TTL input capability. Supplied shortform with components to build the transmitter only.

K 2862 **$15.95**

A 0201 Laser Pointer **$59**

Mini-Strobe Kit

(See EA, Aug '97) Taking advantage of a new range of white LED's this mini strobe can be used to measure the RPM of any thing that rotates or moves. From 400 - 4000 RPM , the strobe rate can be increased until the object motion appears to stop, then the RPM can be read off the scale on the front panel. Supplied with a project box with silk screened front panel, the kit has provision on the PCB to expand with the addition of more LED's, variable pulse width and an addition to allow the measurement of pulse width on a frequency counter. Requires 9V battery (not included).

K 5785 **$21.50**

Video Enhancer & Stabiliser

NEW!

(See EA, Nov '97) Ever transferred your home or holiday movies to VHS and found the picture quality is degraded? This little enhancer will spruce up the video signal, and can even improve the quality of poorly-recorded video. It also has an image stabiliser which removes all the invisible overheads from video signals, such as teletext data, leavinbg a clean PAL composite signal. *If you're into making your own movies or taking some holiday footage, this is a very useful accessory!*

K 5830 **$59**

Megger Meter Kit

(See EA May '89) This design of an electronic meg-ohm meter features a dual voltage of 500 and 1000V with a large scale meter. It can resolve resistance from 1M to 200M ohm which is ideal for insulation testing of cable, transformers, motor windings, HT circuits etc. ***A must for checking earth leakage! Build your own megger meter and save $$$!!***

K 2555 Was $79, Now JUST **$69**

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Doc GL750

Experimenting with Electronics

by DARREN YATES, B.Sc.

Battery chargers 101 — Part 1

This month, we kick off with a new topic. We're going to look at batteries — from building a simple battery from parts in the kitchen to reviving dead NiCad cells.

Batteries — so what? They're everywhere. Phones, personal stereos — anything you can carry these days seems to have a battery or five inside. But when you stop to think about it, you can't help but be amazed that when you connect together two dissimilar metals via a reactive substance called an 'electrolyte', you can generate electrical power.

When I was a kid, one of the first things I did was to build the 'backyard battery'. Except I did mine in the kitchen; Mum was not impressed...

But the important thing was, I had demonstrated to myself that I could make a battery — not something that was going to keep my computer going through a blackout (in fact, it probably would have turned up its nose at powering my watch), but a battery nonetheless.

Backyard battery

You've all heard about the one that says a certain famous brand of cola soft-drink makes pretty good battery acid? Well, I thought I'd give it a go to see how true it was.

Before we build, this first circuit should only be carried out under adult supervision. If in any doubt, don't build it. The cola used in the film-cans will be poisonous once it goes in, so don't drink it whatever you do.

Not that many years ago, we had those wonderful one and two cent pieces. Not that they were all that wonderful from a financial point of view — I can't remember the last time I heard someone jump up and down screaming "I just found a two-cent piece!"...

However, they *were* made from copper and together with a five-cent piece, you could make a simple battery for six cents (plus a few things from Mum's kitchen, but *she* paid for those!). These days, it's a bit more expensive but it still works.

The 'circuit' for the battery is shown in Fig.1. Using four empty plastic film cans, remove the lids and wash thoroughly to remove any film chemicals.

Next take two crocodile clips for each can and solder a connecting wire to each. Next, grab a 10-cent piece in one clip and some tightly wrapped aluminium foil in the other — one of each per can. The foil electrode is made by simply cutting up some foil and folding it neatly and tightly into a 2cm x 1cm strip, then grabbing it in the jaws of the clip at one end.

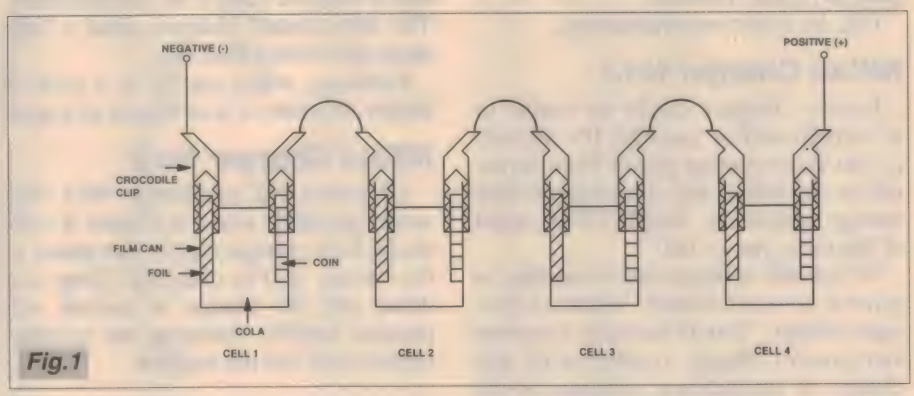

Fig.1

Now comes the tricky part. Open the jaws of each of the clips so that the 10-cent piece is jammed against one side of the film-can wall and the same with the other. You get a sandwich effect, with the coin and foil jammed against opposite sides of the film can.

After that — and this is the really scary part — get a can of cola and pour some of the liquid into each film can.

The final thing is to join each 10-cent clip of one can to the foil clip of the next, so that you create a chain. At the end you should be left with two unconnected clips — the 10-cent clip at one end and the foil clip at the other end.

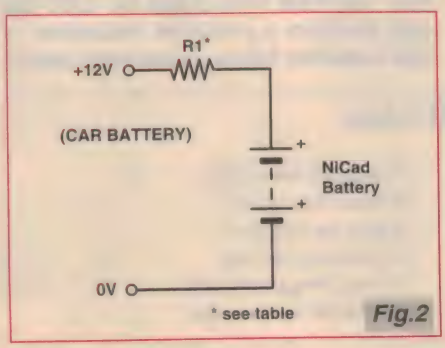

Fig.2

If you now connect up your multimeter, set to volts, to both ends, you should find that you get a voltage happening.

The only problem though is that while the 'battery' produces about 1V, it can barely produce enough current to power a crystal radio. If you switch your multimeter to milliamps, you'll be lucky to register a sniff! About as good as you'll get is around 0.5mA. So much for the cola theory...

Another product you can use for the electrolyte is a window cleaner with ammonia. I tried this with a single cell and managed to scrape up 1V. The short-circuit current was about 2mA.

As I mentioned before, don't build these batteries without adult supervision. I don't want to read obituaries of people drinking cola from a film can, and/or choking on wads of aluminium foil...

Batteries 101

In a nutshell, batteries are a bit like our school education system — they come in either *primary* or *secondary* versions. Primary cells are those which go flat and stay flat, while secondary cells are those that can be recharged.

At this stage, we'll just stick to those cells that are designed to be recharged. There has been plenty of talk over the years of recharging standard carbon-zinc cells. That debate will rage on

without us getting into it, so I don't propose to — unless the Editor is deluged with requests...

The batteries we'll be considering in our circuits over the next couple of months are the standard Nickel-Cadmium cells (NiCads) that you can buy over the counter and throw into your camera flash unit. We'll also look at the Lead-Acid battery, commonly used in motor vehicles.

OK, let's start experimenting...

NiCad Charger No.1

Battery chargers can be as simple or as complicated as you like. It's all really just about getting power from somewhere else stored into one of these little storage containers. Simple? Well, most of the time, yes — but!

NiCad cells recharge best when they're given a constant current. What's a constant current? This is basically a current that doesn't change regardless of any change of surrounding voltages, or the resistance of the load it may be feeding.

Our first circuit in Fig.2 is about as simple as it can get. You're probably looking at it now and thinking, "How can a single resistor produce a constant current?"

On its own, it can't; but for our purposes in this first circuit, it will do in a tight spot. The voltage of a NiCad cell rises from around 1V when flat up to around 1.4V when fully charged. If we charge the cell from a 12V battery — say a car battery, which is really around 13.8V — then the voltage dropped across the resistor will be between 12.8V and 12.4V. That's a change of about 3%, which is plenty constant enough for us.

Looking at Table 1, this is a simple chart which shows you the resistor value and wattage required to charge up a number of cells and types. Note you can also charge up the 7.2V '9V replacement' jobs, but the current won't be constant. You should use either of the next two chargers for this type of battery.

With these resistor values, charging will take about 16 hours. The only problem is that *you* have to be the timepiece. The auto-shutoff chargers need a little more electronics than this.

However, when you're in a spot of bother, this circuit is as simple as it gets.

Nicad Charger No.1: Resistor R1 values

Cell type	Charge current	1 cell	2 cells	3 cells
110mAh 9V	11mA	680 ohms		
500mAh AA	50mA	220 ohms/1W	220 ohms/1W	180 ohms/1W
600mAh AA	60mA	180 ohms/1W	180 ohms/1W	150 ohms/1W
1.2Ah C	120mA	100 ohms/2W	100 ohms/1W	82 ohms/1W
2.0Ah C	200mA	68 ohms/5W	56 ohms/5W	47 ohms/5W
4.0Ah D	400mA	33 ohms/10W	27 ohms/10W	22 ohms/10W

NiCad Charger No.2

Of course, NiCad Charger No.1 only works properly when you have a relatively high voltage supply compared to the battery you're charging. Drop that down and the change in current will increase rapidly, throwing our constant current idea out the window.

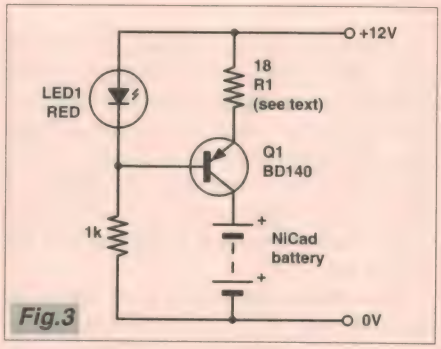

Fig.3

And that's where NiCad Charger No.2 fits in. The circuit in Fig.3 gives us that bit more control over the situation, making it easy for us to charge everything from D cells down to button cells for cameras and watches. The other bonus is that the charge current is fixed regardless of how much the supply voltage varies, within limits.

Looking at the circuit, it contains just a single transistor, a LED and two resistors. The trick here is that the LED not only provides a power-on indication — this is another bonus — but more importantly, it acts as a reference voltage.

Although it will vary slightly depending on the brand of LED you buy, a standard 5mm red LED has a forward voltage drop of around 1.6V. Now if we assume a base-emitter junction voltage of 0.6V, this means that we have 1V dropped across resistor R1. Because of the constant forward voltage of the LED, it doesn't matter too much what happens with the supply voltage (within reason); the voltage across R1 remains the same. This means that the current through resistor R1 is also constant.

The formula for the battery charge current is then:

$I_{batt} = 1/R1$

where I_{batt} is the battery charge current in amps, and R1 is in ohms.

The general rule is that you can charge fully-discharged NiCads at one-tenth of the capacity for 16 hours and they'll then be fully charged.

With the components shown, you can charge up two 'AA' NiCads quite happily.

Note that, again, *you* will have to be the timer. This circuit will just keep on charging the cell whether it's had enough or not, so don't let it go for more than about 16 hours.

For other cells numbers and sizes, use Table 2.

NiCad capacities

To give you some brief information on the capacities of these NiCad cells, common 'AA' sized cells have a capacity of usually 500mAh (pronounced 'milliamp-hours') while 'C' cells hit 1.2Ah (amp-hours) and 'D' cells, 4Ah. The 9V replacement batteries are commonly 110mAh.

So what does this mean? If you take a 'AA' cell with its 500mAh capacity, you should be able to drain that cell at 500mA for one hour, or 250mA for two hours, or 100mA for five hours or — you get the idea. The other cells have corresponding values.

Well, at least that's how it's supposed to go in theory. In practice, if you drag 500mA out of a 'AA' cell it's likely to

Nicad Chargers No.2 & 3: Resistor R1 values

Cell type	Charge current	
110mAh 9V	11mA	91 ohms (one battery only)
500mAh AA	50mA	18 ohms (up to six cells)
600mAh AA	60mA	18 ohms (up to six cells)
1.2Ah C	120mA	8.2 ohms (up to six cells)
2.0Ah C	200mA	4.7 ohms/1W (up to six cells)
4.0Ah D	400mA	2.7 ohms/1W (up to six cells)

give up in around 45 minutes or less. However, you're more likely to get 50mA for closer to 10 hours. It has to do with the cell's capacity to deliver that sort of current. In general, NiCads are better at delivering higher currents than carbon-zinc or alkaline batteries. The same thing happens to *these* cells if you try to crank out 500mA, but the problem is worse.

Alkaline cells have a lot in their favour though. Firstly, they have higher cell voltages — 1.5V against the NiCad's 1.2V. They also have a higher capacity, cell for cell. 'AA' alkalines live for 1.5Ah, 'C' cells for 4Ah and 'D' cells for 10Ah. These are figures from a Duracell handbook that came out about five years ago.

NiCad woes

Anyone who's ever used NiCad batteries for long periods, whether it be in flash guns or mobile phones, knows that NiCads are a necessary evil — and can cark it on you when it's least convenient.

The problem is that these cells suffer from what's called the 'memory effect' and basically, it happens when you don't fully discharge the cell before recharging it. If you just let it run down to say, half way, and then charge it up again, the cell begins to 'remember' this half-way point and starts giving up the ghost when its half-discharged, thinking it's time again for a top-up.

In the end, what happens inside the cell is that crystals form called dendrites and short out the cell internally, to the point where you can charge and charge the thing and it won't even give you a sniff of power.

One way of fixing the problem, which is pretty experimental I might add too, is to 'blow the crystals up' by pulsing the cell with lots of current.

NiCad Blaster No.1

The circuit in Fig.4 is crude, but should do quite a reasonable job. The only problem is that you need a dead cell to try it on. Oh, well — it could be worth keeping in your circuit notebook for that occasion.

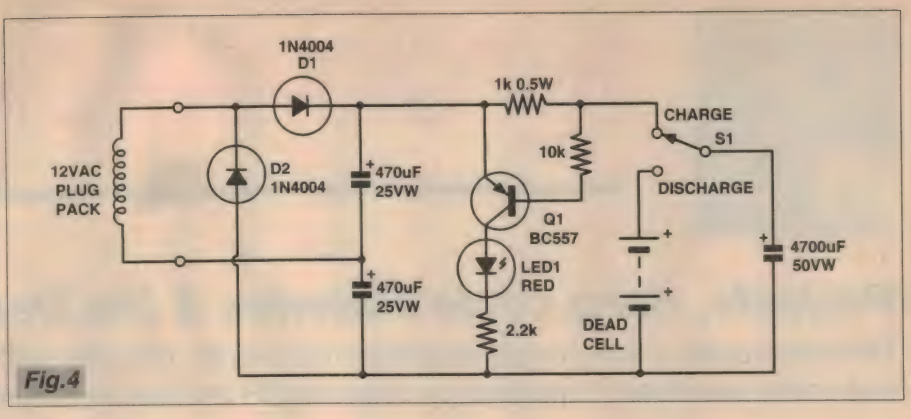

Fig.4

Using an AC plug pack, the diodes double the voltage from the original 12 to around 24V-30V DC and this is used to slow-charge up a fairly hefty 4700uF 50V capacitor. We do it slowly because the initial charge of current through the capacitor would give the plug pack a coronary without that 1kΩ series resistor. With the values shown it should take around 10 seconds.

While the current flows through that 1kΩ resistor, there's a voltage drop across it that keeps the PNP transistor Q1 switched on and the LED connected to its collector lit up. Once the 4700uF capacitor reaches close to full charge, the current through the charge resistor will drop away. And so will the voltage across it.

Once it drops to below 0.7V, the transistor will begin to turn off and so will the LED. This is then the cue to operate switch S1, swinging it from charge to discharge.

The entire contents of the capacitor are now dumped into the cell. In theory, the high-voltage, high-current spike (which only lasts a few short milliseconds) should be enough to blow up the short in the cell, much in the same way you would a fuse.

As I mentioned before, this is an 'experimental circuit'. That's techno-speak for "I can't guarantee it's gonna work..." The theory is good, but it may take more than just a single whack to fix it. In that case, simply charge the cap up again and give it another go...

If *that* doesn't work, you could boost the capacitance up to 10,000uF. This I wouldn't recommend unless you're sure of what you're doing. 10,000uF can produce a pretty severe thump, and dumping that sort of energy into a cell may cause some funny things like cells to leak.

One thing I would do is to check the cell each time you zap it. If it starts getting too warm, and still doesn't work, I'd give it the boot.

A few years ago, I designed a kit for this task. It was quite a bit more complicated than this and worked off a DC supply. It charged up two 1000uF capacitors up to 33V and then a push-button gave the cell the works. Problem was I never heard whether anyone had any success with it or not.

I'd be interested in hearing what sort of results *you* get.

Where this circuit is likely to be of use is mobile phone batteries. These things often keel over within a few months of purchase. My view is that if you've got a dead phone battery, and it's outside the warranty period, you've got nothing to lose by zapping it. If it works, great. If it doesn't, well... you haven't wasted any real money.

NiCad Charger No.3

If you're like me and being in the same place 16 hours later isn't always possible, then our NiCad Charger No.3 should do the trick. It's an extension on No.2 and includes a 16-hour timer which shuts down the charging circuit

(Continued on page 85)

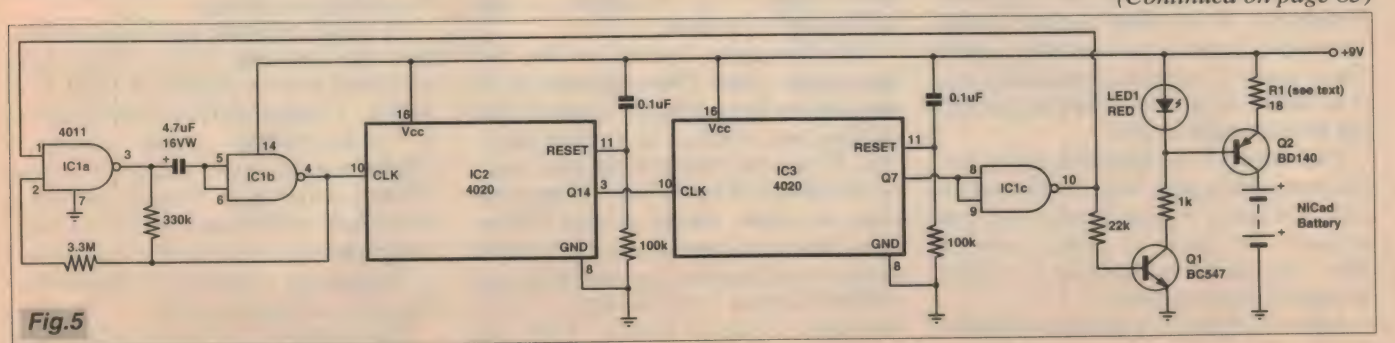

Fig.5

INFORMATION CENTRE

by PETER PHILLIPS

Projects, deep cycle batteries & the Deutsches Museum

There are quite a few project enquiries this month, mixed in with more discussion about Pay TV, and some practical information on repairing IR remote control units.

I'm writing this in Munich (Germany), having just visited the Deutsches Museum. If you get the chance, this is a 'must visit' place for EA readers. It's a technological museum that requires a week or more to explore, but even half a day there will prove a memorable experience.

It costs around $8 to enter, covers over 46,000 square metres and has 53 exhibitions that include electrical power, cars, railways, scientific instruments, chemistry, physics, microelectronics, astronomy, amateur radio, energy — even technical toys. A museum guide (in English, cost of around $4) is available which shows where each exhibition is located, along with highlights of each one. Unfortunately I purchased this guide after I'd finished my tour, so I missed out seeing the amateur radio and microelectronics exhibitions. Even so, I got to see some pretty amazing stuff. Here's some of the highlights:

The electrical power exhibition has the first DC generator, built by a man called Pixii in 1832. Many people attribute this invention to Faraday, who discovered electromagnetic induction in 1831. But as far as I know, his generator of the same year is really an alternator, not a DC generator. The Pixii apparatus (see Fig.1) has a cam-driven switching system that converts the AC output to DC. The commutator as we know it today came later (attributed to Gramme, in 1869).

I had hoped to include an actual photo of the generator, but as my photos have yet to arrive, I've used a sketch from an old book I described in an article in May 1990. Notice that it shows a commutator, which I now know is incorrect. Presumably this is an artist's error, as the commutator had not been invented in 1832.

Pixii seems to be forgotten today, but his generator is quite large (over a metre tall), and has a wooden framework that supports two coils of cotton covered wire. The permanent magnet is rotated by hand through gearing.

Also on display is a Siemens dynamo from 1866 (Fig.2), regarded as the first practical means of producing useful amounts of electricity. There are also many other generators and alternators, some of which I described in the above-mentioned article. The overwhelming aspect of course is that these are the actual devices, not reproductions. If you take children, they will enjoy the demonstrations of high voltage discharges, with the accompanying thunder.

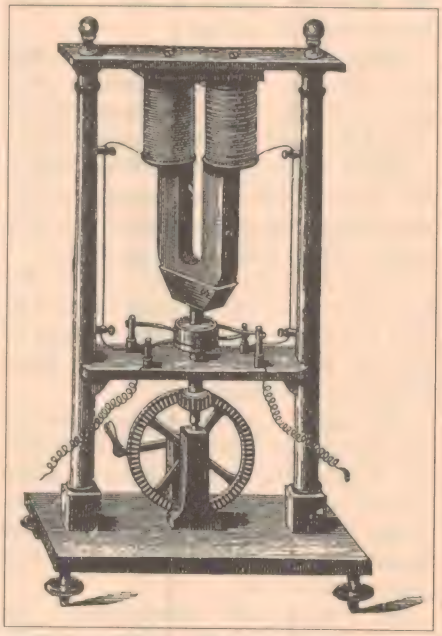

Fig.1: Is this the first DC generator? It was built by Pixii in 1832, and although not shown in this illustration, it has a cam driven switching arrangement in place of a commutator.

The automotive section has the first automobile (Benz 1886), donated to the museum by Benz himself. Again it's the original, not a replica as in other museums. If cars are your passion, you won't be disappointed in the other 54 automobiles on show, which include various early Mercedes models, a 1938 Adler with a wood burning gas generator, and a 1921 Rumpler Tropfenwagen — a car you have to see to believe. There are also many motorbikes on display, as well as a 1948 Volkswagen and a model T Ford, donated to the museum by Henry Ford.

The power machinery section has the first Diesel engine (1897), along with other early engines by Otto, Daimler and Wankel. This exhibition also includes original and reconstructions of early steam engines, including a 1788 Watt engine. In the aeronautics display are many examples of modern and early aeroplanes, including the only surviving example of a 1909 Wright brothers Standard Type A plane, alongside a 1909 Bleriot. I was particularly interested in a cut-away of a modern jumbo jet, which shows its construction and the complex wiring to the engines.

Railway buffs will enjoy the many locomotives, both electric and steam, along with an elaborate model railway. This display has a replica of a Puffing Billy and some of the original steam locomotives date back to 1867.

While I didn't get to see it, I'm told the salt mine in the Mining exhibition is a highlight. I did see the mechanical musical instruments section, which includes a Hupfeld Violina (a vacuum operated automatic violin), along with various reproducing pianos (Welte) and other more modern instruments. The time keeping exhibition includes large and small clocks of all types, both modern and old, and the printing section has examples of Gutenberg presses, a Linotype machine and other examples of printing technology.

The Hall of Fame has busts of notables like Einstein, George Ohm (have you ever seen a picture of Ohm?), as well as a portrait of Gauss, all housed in a cathedral-like room with a Michelangelo style painted ceiling. There's also a large canteen, and (as in most parts of Germany), lots of toilets. Only some of the exhibits are described in English, so a German to English dictionary could prove useful.

The museum is in the heart of Munich,

about a 15-minute walk from the Marienplatz, just near the Isar river. It takes about 20 minutes to get there on foot from the main railway station, so a car is not essential. Incidentally, you are allowed to take photographs in the museum. A truly amazing place!

Returning to Oz, we start with our first letter, which is in reply to my comments in September about the reception quality of Pay TV.

Component disposal

We've previously discussed how to dispose of PCB etchant chemicals, but this letter asks about disposing of batteries and other environmentally unfriendly components.

I'm writing about the proper disposal (if there is one) of electronic components. When I left my home country some 20 years ago there were disposal bins in the town for these.

But it seems Australia is still lacking in disposal methods for items such as batteries, PCBs, electrolytic capacitors and so on. I was surprised when I recently bought a new battery pack for my mobile that even at the shop no trade-in or disposal facilities were available, or any information on how I could safely dispose of it. Perhaps your readers can throw some light on this environmental subject. I now save up the old items to dispose of them when a suitable outlet finally appears.

Thank you for the great reading and congratulations on reaching your 75th year of publication. (Peter A. Van der Wedden, by email)

When it comes to the environment, it seems Australia still has a way to go. You don't mention your home country, Peter, but I assume it's somewhere in Europe where the population density is much greater. But sooner or later, we in Australia are going to have to come to terms with the proper disposal of batteries and other chemically-based components. Turning them into landfill can't go on forever, as the chemicals leach into the soil and must eventually poison it.

Like you, I too am interested in what readers might know about this, because as far as I know, there is presently no system in place for disposal of these items. Thanks also for your kind comments about the magazine; we certainly hope it will continue for many more years.

IR remote repair

Some time ago we discussed ways of repairing faulty keys on an IR remote control unit. This letter seeks more information on this topic:

You mentioned previously that a product called Electrolube Silverpaint could be used to repair remote controls for TV etc. Any ideas where this might be available from? (Gerald Oomen, BBS)

I don't recall this product as one that was mentioned Gerald, but I can tell you of one I have used successfully in recent times. The product is Quick Grid Repair Resin, made by Loctite, normally used to repair a car rear window demister. It is available from most Auto shops and I paid around $18. It's a very small bottle, but enough for quite a few repairs.

To use it, it's important to first clean any grease or oil from the rubberised key surface. I also give the rubber surface a rub with fine abrasive paper. I mention this, as one repair I did resulted in the paint coming away from the key surface and sticking to the circuit contacts. This meant the IR remote control unit was permanently on, flattening its battery overnight. This only happened with one key in the remote, so I assumed it to be inadequate cleaning. All other remotes I've fixed with this technique continue to give good service.

24-line PC I/O card

Our next letter asks about the I/O card published in November 1996.

I recently purchased a kit for the 24-line I/O card for PCs from Jaycar Electronics. I'm writing to ask if you can tell me where I can find programming information for the card, and what can actually be hooked up to it. I want to eventually use my PC to control an alarm system, using this card. (Jon Pushong, BBS)

This project, as the article points out, is a revamp of a 1989 *ETI* design. It is based on an 8255 PIO chip, so the inputs and outputs are digital only. As explained in the article, the chip is programmed by sending it a number. The value of the number determines the status of the I/O pins, where some become inputs and others outputs.

The article gives some hints on programming, using either QBASIC or Visual BASIC. I suggest you purchase a book on programming in either of these languages, as although these languages are relatively easy to use, it's beyond the scope of this column to explain programming techniques. Most technical bookshops carry these types of books. But even following the simple instructions in the article should get you going.

Because the inputs and outputs are digital only, you need to interface them to the devices you want to connect to the card. You might find the article Low Cost PC-Based PLC, published *EA* November 1994 useful for some interface circuits. This article shows how to connect a relay to a parallel port using a buffer IC type ULN2003, and how to use a transistor to interface a simple water level switch.

Most alarm systems have digital outputs (eg, from a PIR detector), so you can connect these directly to the input pins of the I/O card. Driving a siren or other output will need an interfacing relay or similar (eg a MOSFET). Incidentally, the November 97 article also has programming hints that might help you.

Pay TV quality

I live in Brisbane and subscribed to Optus Vision for two months and now subscribe to Foxtel (I did not find sufficient value in Optus' program range).

I agree with your comments about Foxtel picture quality. The main benefit with Foxtel's re-broadcast free to air channels is the reduction in ghosting. I judge picture noise to be slightly higher than that available direct from my aerial (roughly 10km from the transmitters on Mt Coottha).

From recollection, Optus picture quality was better than Foxtel, but still a disappointment. It appears that Foxtel has been supplying stereo audio output STUs in Brisbane since June, as this is the unit I was supplied with. At the time the installers indicated these STUs were new.

Are you planning to take the question of Pay TV technical quality further with Foxtel and Optus? I would certainly be interested to learn why the quality is poorer than I would have expected. (John Thayer, by email)

Thanks for your comments John. You've confirmed what I was told regarding stereo STUs, in that they were being trialed in Brisbane. You lucky people! I have already talked with Foxtel about these issues, but while the front line staff are very pleasant, they lack technical knowledge and seem powerless to do anything, except mollify complaining customers. Getting any further into the Foxtel organisation for information is almost as difficult as breaking into a bank vault.

But perhaps someone from Foxtel will read your (and my) comments, and respond. I would certainly like to know not only why the quality is poor, but what solutions there are — if any.

AM Miracle antenna

We've had a number of reports on how well the November 1996 AM Miracle antenna works. For example, one reader told us he was able to get

excellent reception of 2CH (Sydney) at Lightning Ridge. The following letter also points out how well the antenna works, so much so that the writer wants to use it with his car radio:

The AM Miracle antenna project is amazing. Using my old Sanyo cassette radio, I can even pick up stations from different states. It works so well, I'd like to use it with my portable Ford car radio, which is only able to pick up a few Sydney stations. I contacted Oatley Electronics who suggested a possible method, but it didn't seem to work. Can you help me? Incidentally, I want to thank Ana Marie Zamora, your secretary, for the exemplary, courteous, efficient and obliging way she handled my phone enquiry. (Ken Heydon, Coonabarabran, NSW)

Thanks Ken, for your kind comments about Ana Marie, our secretary and reader services coordinator. We value her enormously, and I'm sure many readers who have spoken with her would agree with your comments.

Interfacing the Miracle antenna to a car radio could be difficult, as the whip antenna used with most car radios forms part of its RF tuning system. There is usually an adjustment in the form of a trimmer capacitor inside the radio, to 'peak' the tuning of the antenna and its connecting coax cable.

The method of connecting the Miracle antenna suggested by Oatley Electronics (see Fig.2) should work. However, you'll need to tune this system to the radio. I suggest you either fiddle with the internal antenna trimmer capacitor, or if it's out of range (or there isn't one), change the number of turns on the winding that connects to the radio via the coax cable. This is really a trial and error thing, as you are trying to simulate a car whip antenna (plus coax) with this circuit. It will obviously need some work to get it right.

Deep cycle battery

Do you know the difference between a deep cycle and a conventional car battery? The next letter asks about charging a deep cycle battery:

I hope you can help me with a problem I have concerning a solar power system I have in a caravan. The battery is a deep cycle type and is charged from the solar panel. However, it won't charge from the car's alternator while travelling.

The reason seems to be that the alternator is regulated at 14V, but the battery needs a higher voltage to charge it. I have looked with interest at the Booster for 12V Motors in the August issue, but its output current is too low. I need at least 5A. Can this current rating be increased?

I have no problem with the solar panel, but conservationists notwithstanding, solar panels aren't always satisfactory. I admit to a limited knowledge of solid state theory, but I do have a reasonable knowledge of automotive electronics. I would therefore not try to alter the output voltage of the alternator, as it could damage the engine management 'black box", which costs $1200 to replace.

I know that there is a difference between conventional and deep cycle automotive batteries in regard to their charging requirements. Perhaps you can elaborate. (R. Gebhardt, Mount Bryan, SA)

According to my sources, Mr Gebhardt, there's not a lot of difference between a normal and a deep cycle car battery in regard to their charging requirements. Here's what Century Batteries say about their deep cycle series of batteries, in a technical document we obtained:

Positive and negative battery grids are made from an antimonial alloy designed for its cycling attributes. Batteries are not maintenance free, but have reasonably low gassing rates and consequently little water loss when operating in a normal automotive type voltage regulator situation. The grids are pastes with a high density mix which improves the 20Ahr capacity rating, although reducing the immediate cold cranking ability.

Fibreglass supplements the PVC plate insulation to help produce a tight packed group which also helps hold the separators in position. This design, especially with flat sheet type separation, improves group integrity but the higher internal electrical resistance slightly lowers the 'top of charge' charge acceptance. The need to boost charge and preferably cycle new batteries at least once before sale is of utmost importance.

If the deep cycle series are expected to operate in a deep (greater than 50%) discharge cycling mode with charging regulated below 14.5V, then some occasional boost or equalising charge is essential. Apart from all other considerations, the depth of discharge has a direct effect on battery life, with deep cycles doubling the amount of energy taken out of each cycle and halving the life expectancy.

This last statement seems to contradict the purpose of a deep cycle battery, which is to permit deep cycling without detriment to the battery. Exide have this to say about their Endurance range of deep cycle batteries:

A deep cycle battery is constructed in such a way that repeated discharge/recharge situations have much less of an adverse effect on the battery's life or performance, compared to a conventional battery.

However, Century says in a promotional brochure: *A deep cycle battery's construction allows it to withstand a much greater loss of its power (deep cycle) without sustaining the life-shortening damage such use would cause to a standard battery. It is designed to go through this cycle repeatedly.*

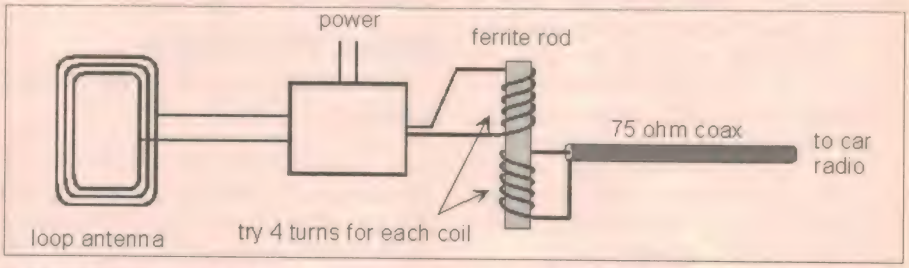

Fig.2: Suggested method of connecting the AM Miracle antenna to a car radio. The radio will need to be tuned to this system for best performance.

Century doesn't give any information on charging a deep cycle battery, but Exide says:

Never leave a deep cycle battery in a discharged condition. After it has been discharged, make sure it is given a full charge, either by an engine charging system or by bench charging.

I've summarised the information I have on this type of battery, but it seems several important points emerge. The first is the higher internal resistance of a deep cycle battery, which means it must have a lower maximum current drain compared to a conventional 'shallow cycle' car battery. And as Century points out, this higher resistance also slightly affects the ability of the battery to become fully charged. I guess this means the charge voltage must be increased to obtain full charge. However, the use of the term 'slightly' suggests this is not a major factor.

The second point is that although a deep cycle battery can be discharged to

a lower level than a conventional battery, its life expectancy is still reduced. However I assume this effect is better than that for a conventional battery. Otherwise, what's the point in a deep cycle battery! Furthermore, the available literature doesn't give any figures on a suitable depth of discharge, or how many deep discharge/charge cycles a deep cycle battery will give.

But finally, let's return to charging a deep cycle battery. All the literature I've got either doesn't mention the charging needs, or suggests this type of battery has no special needs. So Mr Gebhardt, it might be that you have another problem regarding your battery installation. Perhaps your switching arrangement between batteries and the alternator has a high resistance connection somewhere. But certainly it seems as though a deep cycle battery can be charged from a conventional car charging system.

Laser link specs

According to the next letter, the Laser Link Communicator project we described in July lacks specifications:

I would like to see some specifications for the communicator. The text uses terms like 'a few hundred metres', 'seemed to cover the full bandwidth' etc. It would be great to have some more exact measurements.

For example, what is the possible bandwidth? What is the maximum distance the communicator has been tested over? Is this version suitable for transmitting data? Also, what is a safe distance from the laser diode to avoid risk of eye damage? Louis Challis would be a great choice to do some testing on the prototype. (Ted Breen, Concord, NSW)

Ted, I agree that the text is rather vague when it comes to describing the capabilities of this project. However there's a good reason for this. This project is sold as a kit, in which the construction, alignment etc is done by the constructor. If we, with all kinds of test gear and years of experience, spent the time setting the link up for optimum performance, and then reported our findings, it's likely many constructors would complain that they were unable to get the same performance.

For this reason, with kits of this type, we prefer to give 'ball park' figures rather than optimised values. For instance, the operating distance can be anywhere up to a kilometre or more, with the right type of receiving optics. As a direct link (no focusing system), the distance depends on the alignment, the sensitivity of the photodiode and other factors. A 'few hundred metres' is therefore enough to give a guide that you can use this link between two houses, or across the road. If we said 522 metres (assuming this is what we obtained), some readers might not be able to achieve this, and would complain that we had misrepresented its performance...

The same thing applies to bandwidth. The kit comes with a low cost electret microphone, which alone is likely to affect the bandwidth. A higher quality mic would improve this, but most people are not going to build the unit for its fidelity, simply for its communicating ability. Our report that the link seemed to cover the full bandwidth is therefore a guide, and not intended as a specification.

Yes, it can be used to send digital data. However alignment and stability become more important, so we did not discuss this as a possible use.

As for a safe distance to view a laser beam, I guess this is like asking what's the safe distance to stand in front of a gun. Obviously, in practical terms, there must be a point at which the energy in the beam is low enough to be viewed directly. But, even if I knew, I would not be game to say what this distance was. Can you imagine the lawsuits?

What??

We haven't had an op-amp problem for some time. The following question comes from Bryan Maher, author of *Op Amps Explained*. With a bit of Ohm's law, it's easy enough to solve:

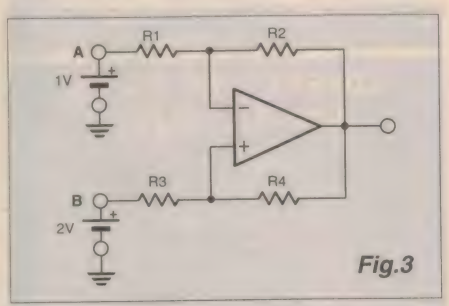

Fig.3

For the circuit in Fig.3, assume an ideal op-amp and that all resistors have the same value. Find the impedance looking into terminal A (with respect to ground), and also the impedance looking into terminal B, again with respect to ground.

Answer to October's What

Paul crosses with John, so two minutes elapse. John returns (three minutes have elapsed) and George crosses with Ringo (13 minutes elapsed). Paul now returns, so 15 minutes have elapsed. Finally, John and Paul cross — giving a total time of 17 minutes. ❖

(Continued from page 81)

after it times out. It also snuffs out the charging LED, to show you charging has ended.

Looking at Fig.5, the timer is the most complicated bit. We probably could have done it all using just a single 4060 IC with its internal oscillator and 14-bit counter, but it means the clock has to run too slowly to make the circuit reliable. So I took the step of using a faster clock with more counter stages.

With the components shown, the circuit will charge up two 'AA' cells for 16 hours and then shut down.

If you look closely, you should be able to see that this borrows from Fig.4 in July 1997's Experimenting with Electronics, except that our control output comes from Q7 of IC3. This gives us 65,536 seconds or 18 hours. Just too long, it seems.

As it happens, though, the time is only 10% or so out and this is inside the error margin for the capacitance of the 4.7uF capacitor. So we can leave it as it is. A couple of extra hours won't make too much of a difference. However, 36 hours would be far too long and nine hours not enough.

When power is applied, the counters reset themselves so that all outputs are low, thanks to the RC network connected to each reset pin. This makes the output of IC1c high, which fires up the oscillator (IC1a and b) to start the timer. Once the 18 hours or so are up, Q7 of IC3 goes high and the output of IC1c low. This not only switches off NPN transistor Q1, shutting down the charging part of the circuit, but it also pulls pin 1 of IC1a low and stops the oscillator. This ensures that the timer stays stopped and the charger stays off. Again, the fact that the LED is off will indicate that the charging has ended.

To test the circuit, simply speed up the clock by replacing the 330kΩ resistor with a 3.3kΩ resistor. It should now take about 10 minutes.

The only way to reset the circuit is by switching it off and on again. This ensures that the circuit can't be reset by mistake.

Finally, to adjust this circuit for other cell types and numbers, use Table 2.

OK, that's enough for this month. Next time, we'll continue with our look at battery chargers and go through some more pertinent issues. See you then.

(Darren Yates is Technical Editor of the Sydney Morning Herald's IT Computer section) ❖

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Lights Controller

(Continued from page 65)

relays and makes the lights chase in one direction for 15 seconds, then reverse direction:

```
'Chaser
dirs=%11111111
start:
for b2 = 1 to 20
for b0 = 0 to 2
lookup b0,(1, 2, 4),b1
pins = b1
pause 200
next b0
next b2
        ...next the same loop, but
        with the lookup list reversed
goto start
```

Timing too

We can also use lookup loops to determine the lengths of pauses. Instead of the single line 'pause 200' in the program above, we could have a line which begins and ends like this:

```
lookup b2,(400, 390, 380, ... 220, 210, 200),b3
```

This is followed by 'pause b3'. The chasing accelerates.

There is virtually no limit to the complexity of the lighting schemes possible using this technique. As a general procedure, draw up a table listing the sequence of offs and ons as binary numbers. Then convert the numbers to decimal and produce the lookup list. You need a variable (usually the loop variable) to index the values in the list. The same can be done with timings, as just demonstrated.

Although we have described the most complex situation, controlling eight relays, the same system can be used, though more easily, with fewer relays. As an example, Table 1 shows how to plan a display which has a set of chasing lights (relays 0 to 2), a fast-flashing set (relay 3) and a pair of slowly alternating flashers (on the n/o and n/c contacts of relay 4).

Setting things out systematically like this, you can better imagine what the display will look like and you can also see that this one repeats every three seconds. So the lookup list is (25, 18, 28, 1, 10, 4). All time intervals are the same, so we have PAUSE 500 in the loop. If the timing is not regular, write a lookup list for this too.

Optional input

Pushbutton S2 allows you to exercise some control over the way the program runs. Most often it is used to change from one lighting sequence to another. If you have programmed two sequences, you can toggle from one to another and back again by using a program such as this:

```
'toggle
dirs = %01111111
start:
gosub one
if pin7 = 1 then start
middle:
gosub two
if pin7 = 1 then middle
goto start
```

The program has two subroutines, which would be labelled 'one:' and 'two:', listing the two lighting sequences. Note the leading zero in the 'dirs' statement, which makes pin 7 an input. Normally this is held high by R1, so the Stamp repeats subroutine one. But if S2 is pressed and held, the Stamp drops through to subroutine two the next time round. Similarly, if S2 is pressed at the end of subroutine two it goes back to start: and repeats subroutine one until S2 is pressed again.

This program can be extended to a chain of subroutines, so that the Stamps drops through to the next sequence each time S2 is pressed, returning to the first sequence after reaching the end of the chain.

So there it is — a very flexible control system for Christmas lights or similar applications, taking advantage of a BASIC Stamp to allow you to do it all using very simple hardware. Have fun, but remember to take great care with that mains wiring! ❖

PARTS LIST

Note: Where indicated by *, the numbers required of certain parts depend on the number of relays.

Resistors

R1	10kΩ 0.25W, 5% (optional)

Semiconductors

D0 - D8*	1N4004 rectifier diode
Q0 - Q8*	VN10KM N-channel MOSFET

Microcontroller: Parallax Stamp BSC1-1C (development kit and PC required for programming). The project could also be controlled by a Counterfeit (see review EA July 1997). Both are available from MicroZed Computers, of PO Box 634, Armidale NSW 2350. Phone (067) 72 2777 or fax (067) 72 8987.

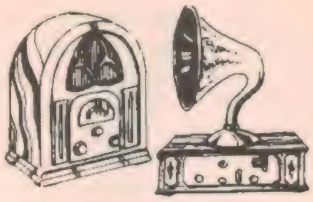
Miscellaneous

RLA0 - RLA8*	. . .DPDT PCB-mounting relay (Jaycar Cat. SY-4052)
SK1	14-way SIL connector
SK2	3-way SIL pin header
SK3-SK6*	5-way pin header and socket (2 per Extension board)
S1, S2	N/O Pushbutton (S2 is optional)

Master board PCB, 106 x 49mm; Extension Board PCBs* (optional, 1 or 2); enclosure, such as Jiffy Box 195mm x 113mm x 60mm, or possibly larger; grommet for mains cable; 12V DC supply (12V battery or 12V 500mA regulated mains plug-pack); mains plug, panel-mounting mains sockets and mains cable, depending on power-switching scheme (or low-voltage alternatives).

Vintage Radio

by ROGER JOHNSON



The year that was: 1925

If 1924 was the most expensive year in radio, 1925 saw the beginning of cheaper prices — a trend which has endured to this day! Also, 1925 saw the last throes of the bright emitter valves which had been used in the earliest receivers.

In preparing this month's column, I found resource material available from early magazines published in three states: the Melbourne based *Listener In*, the Sydney based *Wireless Weekly* (ancestor of *EA*) and the Adelaide based *South Australian Wireless and Radio Weekly*. Collectively these allow a pretty good idea to be gleaned regarding the state of the industry in 1925 and the important issues of the day.

The *South Australian Wireless and Radio Weekly* carried an editorial, and one of the big issues was a fairly rigorous expose of the new transmitter for

an estimated 75% — not a bad little system, when you think about it!

The reason for an injection of capital was to spend £20,000 on a new 5kW transmitter, which was to be the talk of the town. However the scheme was plagued with technical problems, and all four editorials of the *South Australian Wireless and Radio Weekly* during November 1925 were critical of the performance, programming and quality of the transmission. Why, they asked, could the 'B' class station 5DN, broadcasting on merely 300 watts, out-

of fixed value!

Here, for example, is how to adjust the detector circuit. Adjusting the RF and AF circuits was equally as involved:

Wire up L3, C4, L4, C4, GL, jack and batteries. Do not connect L3 to the second valve, but take a pair of flexible leads from the aerial and earth and attach to the opposite ends of L3. Insert valve, and turn rheostat until valve lights. The plate voltage to be that specified by the valve manufacturer.

Move L4 up to L3 and see if valve oscillates. Touch a moistened finger to the aerial end of L3 and if a thud is heard each time, it indicates oscillation. If this does not happen, reverse the connections to L4, increase filament current and plate voltage, also alter grid leak resistance.

When oscillating, adjust set this way. Move L4 up to L3 until set oscillates, and reduce filament current as much as possible. Now loosen the coupling between L3 and L4 until the oscillations stop, and note the position of L4. Loosen the coupling as much as possible, and gradually tighten again. If set oscillates at the exact spot where it stopped, the set is OK.

If not, adjust the plate voltage, grid leak, and try different coils for L4.

Fig.2: This Amplion model AR 58 speaker is of 1925 vintage and was probably priced at eight pounds — well over a week's wages at the time.

phony going on it will be very indistinct and distorted. Loosen coupling between L3 and L4 until the telephony is clearest, and then retune C3. When it is at its best adjust the grid leak until best results are had.

There! That has taken care of the detector stage, and a similar rigmarole is required for the other stages. coils were often the 'basket-weave' variety for use with adjustable coil holders, and in many instances were mounted on the front panel. Solenoid coils and variable capacitors for reaction were still a year or two away.

Other construction articles dealt with making a battery eliminator, making 'slop' or wet rectifiers, how to construct your own audio transformer, and a forerunner of a matchbox crystal set. Battery chargers were also described for both LT and HT accumulators, whilst technical articles about antenna coupling and losses in tuned circuits also appeared. News of amateur activity was prominently featured, and the exploits of Mr S.R. Buckerfield of Adelaide and Mr Max Howden of Melbourne were mentioned.

News of the radio clubs also received coverage — just what club was doing what, the achievements of individual club members and so forth.

The valves

Finally, a few words on the range and price of valves available in 1925. The Radiotron UV 201 was being superseded by the lower consumption UV 201-A, priced at 17/6d ($1.75), and its clones were the De Forest DV2 and Philips C 507 at the same price. De Forest also released the DV3, a clone of the UV 199. The Philips equivalent was an A 306.

SHORTWAVE LISTENING

with Arthur Cushen, MBE

Radio Australia downgrading services

The Mansfield Report on the ABC released in January has had repercussions on Radio Australia, with the reduction of many of the language services and the closure of the transmitting complex at Darwin.

The reduced funding to the Australian Broadcasting Corporation has meant that Radio Australia has suffered as a consequence. Despite a Senate hearing on the matter the funds which were allocated in the past were not available and so a gradual reduction in languages and transmitting facilities were inevitable.

The closure of the Darwin transmitting site, which consisted of five 250kW and one 300kW transmitter (which had been moved from Carnarvon) has meant difficulties in Radio Australia serving Asia. RA has been forced to use the transmitters at Shepparton in Victoria to try and reach this audience, with six transmitters of 100kW and one of 50kW, and also the other site at Brandon in Queensland where there are three 10kW units.

According to the report of the Australian Senate Foreign Affairs, Defence and Trade References Committee, listeners' mail not only provides an indication of the size of an audience but also its strength and loyalty. According to Radio Australia 'there are strong indications that the people who write to international broadcasters are often the most enthusiastic and motivated of the listeners and for them radio, and particularly international radio, is overwhelmingly their major source of world news, ahead of television and newspapers etc.'

In 1995-96 Radio Australia received nearly 100,000 letters. These included 31,500 letters in Indonesian, 46,500 in Chinese and 11,000 in English. In addition, Radio Australia received 30,500 letters in response to a competition run only for a fortnight. The total number of letters for 1995-96 was nearly 130,000.

In 1996, Radio Australia received 51,658 letters to its Chinese unit compared to 24,492 to the BBC World Service Chinese unit and approximately 36,000 to the Chinese section of Voice of America. The Radio Australia Indonesian unit received more than 33,000 in 1996 compared to approximately 4000 to Voice of America's Indonesian section and 25,583 (which included 12,080 competition entries) to the BBC World Service's Indonesian section. It is obvious from this Report that Radio Australia had a large audience overseas.

The present position is that broadcasts in Chinese are continuing, but the possibility of being heard in China on the transmitters at Shepparton is very remote. The Darwin complex (which has been recently upgraded) is sitting idle, but already the BBC, Voice of America, Deutsche Welle and other international broadcasters have made approaches to Radio Australia to lease the transmitters for broadcasting into Asia.

The history of Radio Australia goes back to December 1939, when part of the ABC commenced an international service from Lindhurst and later Shepparton. In the 1970s Darwin was added, only to be devastated on its site on Cox Peninsula by Cyclone Tracey. Later Carnarvon in West Australia was added and it was the first to close in 1995, one transmitter being moved to Darwin.

The reduction of staff of Radio Australia, which had its independent studios in a Melbourne suburb and is now part of the ABC complex in Melbourne, was the first move to reduce the expenditure of Radio Australia as an independent ABC funded broadcaster.

There are many listeners in the South Pacific who will miss the features broadcast by Radio Australia, which is increasingly relaying programmes from the Domestic Service so that it can provide a 24 hour broadcast to the Pacific rim area.

Expansion at KWHR

A second 100kW transmitter has been added at the KWHR site at Naalehu at Hawaii, and is being used 24 hours a day for a service to China and Asia. The original transmitter installed at the same site was opened on December 25th, 1993 and is a Harris 100kW unit which is operating 24 hours a day carrying programmes to the south Pacific.

The aerials at the site include a Slewable Dipole Curtain Array and a Log Periodic antenna. In the past with one transmitter the programmes had been beamed to China for 20 hours and the South Pacific for four hours each day. The initial tests on the new transmitter were carried out at 1300-1900 on 6020kHz, 1900-0700 on 17,555kHz and 0700-1300 on 11,565kHz.

The station relays via satellite programmes originating from the key station at South Bend, Indiana, WHRI.

The mailing address for reception reports is PO Box 12, South Bend, Indiana 46624, USA. ❖

AROUND THE WORLD

GREECE: The Voice of Greece is using a VOA transmitter at Delano, California to the South Pacific 0600-0800 and 0900-0955 on 9775kHz.

IRELAND: West Coast Radio has been heard in Australia and New Zealand on Thursdays 0700-0800 on 9700kHz using a German transmitter. The station gives excellent reception here. This was a test period and if there seems to be sufficient interest in this broadcast it could be a regular weekly feature.

JAPAN: Radio Japan's latest schedule shows English to Oceania 0100-0200 on 21,610kHz; 0300-0400 on 17,685kHz; 0500-0800 on 11,920kHz; 0700-0800 on 11,850kHz and 1800-1900UTC on 7140kHz.

KUWAIT: Radio Kuwait beams to the South Pacific 0445-0930 and 1315-1730 on 15,110kHz. English is on 11,990kHz at 1800-2100 to Europe and North America.

MALTA: VOM has been heard on Sundays in English 0200-0330 on 15,550 and 17,570kHz, both with strong signals. The programme included a variety of features and frequent announcements for letters from listeners. The station is using a German transmitter.

MEXICO: XERMX, Radio Mexico Internacional (PO Box 21-300, 04021 Mexico, D.F, Mexico) verifies with a letter, background and report as well as a sticker and pennant. The schedule is 1200-1600 and 1800-0500 on 5985 and 9705kHz. English is on at 1400-1430, 1500-1530, 1900-1930, 2000-2030, 0300-0330 and 0400-0430 UTC.

NEW ZEALAND: RNZI Mailbox is now broadcast at an additional time of 1130-1200 UTC on every second Monday, on 9700kHz. This signal should be received at a more convenient time in North America. The other broadcasts are Monday 0430 on 15,115kHz, Thursday 0830 on 9700kHz and Fridays at 1930 on 6145kHz.

TAJIKISTAN: Radio Tajikistan, Dushanbe is heard in English 0345-0400 on 11,620kHz and following an interval signal gives schedule and news plus comments to sign off at 0400. This transmission seems to be beamed to Asia.

USA: WINB, Red Lion, verified with a card and gave the following schedule: 2000-2400 on 13,790kHz; and 0000-0600 UTC on 11,950kHz. The power is 50kW.

WESTERN SAMOA: The Government has decided to rename the country to Samoa. It has an agreement with American Samoa to make the change. Apia is on 540 and 747kHz mediumwave. ❖

This summary of shortwave listening lists the frequency in kilohertz and the time in UTC (GMT). 11 hours behind Australian Eastern Daylight Time and 13 hours behind New Zealand Daylight Time. The information has been compiled from listening by Arthur Cushen, 212 Earn Street, Invercargill, New Zealand, who would be happy to provide additional information and answer any questions on radio listening.

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Here we feature some items from past issues.

November 1947

Automated radio manufacture: A new and entirely mechanical process for producing radio receivers at a rate of one every 20 seconds has been developed and put into use by John Sargrove Ltd, at Walton-on-Thames, London, England. The new process, known as ECME (Electronic Circuit Making Equipment) differs in many ways from systems using printed, deposited or sprayed conductors.

The whole process is mechanical. One operator feeds bakelite blanks to the input end of the 70ft long machine, and a second inspects the finished panels as they emerge. Every stage of the manufacture is electronically controlled; each part of the machine starts automatically when work comes in on a conveyor, and stops automatically if it has nothing to work on.

The basis of the ECME system is that an entire circuit is built on a preformed bakelite blank, which serves as the panel and the dielectric of the capacitors, the formers of coils and the insulation between conducting paths. The blanks are moulded with grooves and depressions in the surfaces, and the machine sprays conducting metal onto each side before machining away the top surface to leave the components and conductors. Graphite is sprayed on for the resistors.

November 1972

FM for Australia — at last: The Postmaster-General, Sir Alan Hulme, has just announced that the Government has accepted the recommendation of the Australian Broadcasting Control Board to set up a frequency modulation broadcasting service. With the potential for noise free, high quality stereo sound, the new system is likely to become a reality in about five or six years' time.

The announcement comes as the culmination of more than 25 years of controversy as to whether Australia should or should not have an FM service. Experimental transmissions by the ABC were carried out between 1947 and 1968, and following their termination there were many protests and petitions.

Digital TV System revealed: An important development in the evolution of digital techniques for processing and transmitting television has been revealed by EMI. In an experimental system developed by the company, the analog processing system normally used in the television camera is replaced by a digital equivalent.

Digital techniques, already being applied in prototype 405/625 line standards converters by the BBC and IBA, offer the benefit of reduced noise and distortion and improved stability. Similarly the use of a digital video signal at every stage from the camera head amplifier to the transmitter will ensure almost error-free handling throughout. ❖

EA CROSSWORD

ACROSS

1 Desktop device. (8,5)
10 Metallic element good at absorbing neutrons. (7)
11 'Father of electricity', 1540-1603. (7)
12 Assigned property of an electron. (4)
13 Famous electrical engineer born in Croatia. (5)
14 Prefix indicating 15th power of ten. (4)
17 Cover vinyl records. (7)
18 Fulfil requirements. (7)
19 Primary recordings. (7)
22 Alloy (7)
25 Half-cylinders of a cyclotron. (4)
26 Nationality of brilliant physicist Huygens. (5)
27 Determine a point on a graph. (4)
30 Exert electric force. (7)
31 In the line of an axis. (7)
32 One-time message service. (7,6)

SOLUTION TO OCTOBER 1997:

G	I	G	A	B	Y	T	E		C	L	A	U	D	E
L		R		E		E		A		I		P		A
I	N	E	X	A	C	T		B	I	F	I	L	A	R
T		Y		M		H		O		E		I		P
C	L	I	P		H	E	N	R	Y		I	N	C	H
H		S		N		R		T		S		K		O
	S	H	O	O	T		J	E	T	T	I	S	O	N
G				B		B		D		O				E
R	O	C	K	E	T	R	Y		H	O	B	B	Y	
I		O		L		O		A		L		I		D
F	O	U	R		S	W	I	P	E		C	O	N	E
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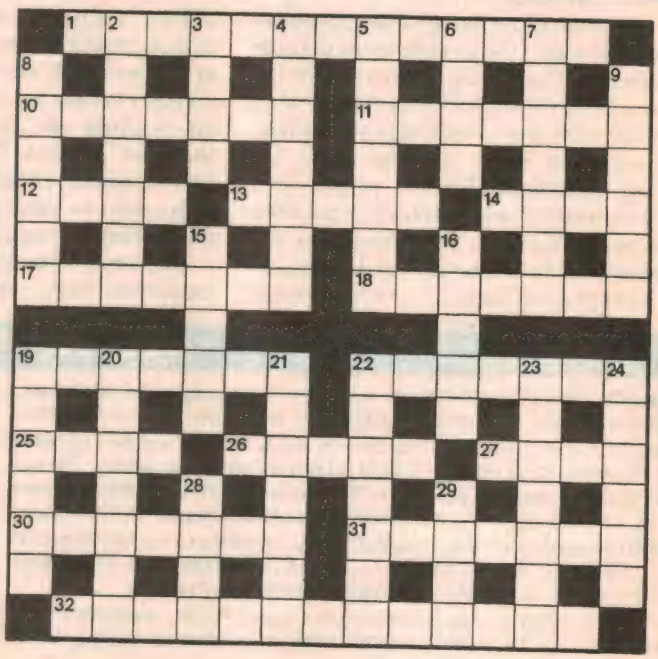
I	S	O	T	O	P	E		G	A	L	V	A	N	I
T		M		L		R		E		U		T		C
H	U	B	B	L	E		N	E	T	S	C	A	P	E

DOWN

2 Not connected to network. (3-4)
3 Imprint on receipt. (4)
4 Interferes. (7)
5 Old name for antimony. (7)
6 Substances used in large transformers. (4)
7 Unit of electrical conductance. (7)
8 Faults on television picture. (6)
9 Alternative to Big Bang, the .... State theory. (6)
15 Home appliance. (1,1,3)
16 Vapour often produced by iron. (5)
19 Middle number, object, etc. (6)
20 Components of complex colours. (7)
21 Space vehicle. (7)
22 Electric light. (3,4)
23 Spacecraft on Jupiter mission. (7)
24 Simple monovalent radical. (6)
28 Streamline. (4)
29 Sound of sonar. (4) ❖



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TAXI BOOKING SYSTEM WINS MOTOROLA RADIO AWARD

REVIEW OF UPSONIC'S NEW PS-MS300: A *VERY* COMPACT 300VA UPS FOR COMPUTERS

SPECIAL FEATURE ON QUEENSLAND'S INNOVATIVE ELECTRONICS INDUSTRY

C-CUBE RELEASES FIRST SINGLE CHIP MPEG-2 CODER/DECODER

HEWLETT-PACKARD'S NEW SURESTORE 'CD-WRITER PLUS' DRIVE: MAKES BOTH CD-R AND CD-RW DISCS "AS EASY TO USE AS FLOPPIES", BUT WITH 650MB OF DATA STORAGE CAPACITY, FULL COMPATIBILITY...

NEWS HIGHLIGHTS

BRISBANE FIRM WINS $38M HK CONTRACT

Foxboro Australia has won a $A38 million international contract to upgrade the control systems for Hong Kong's main railway system. The Brisbane-based Foxboro Queensland Technical Centre, Foxboro's global centre for excellence in transport, won the contract against competing tenders from around the world.

Queensland Premier Rob Borbidge acknowledged the importance of the win for Queensland: "This contract will see the environmental and power control systems for Hong Kong's Mass Transit Rail Corporation (MTRC) manufactured here in Brisbane and freighted to Hong Kong for installation over the four-year term of the contract", he said. "It is a major coup for Queensland and for Foxboro Australia."

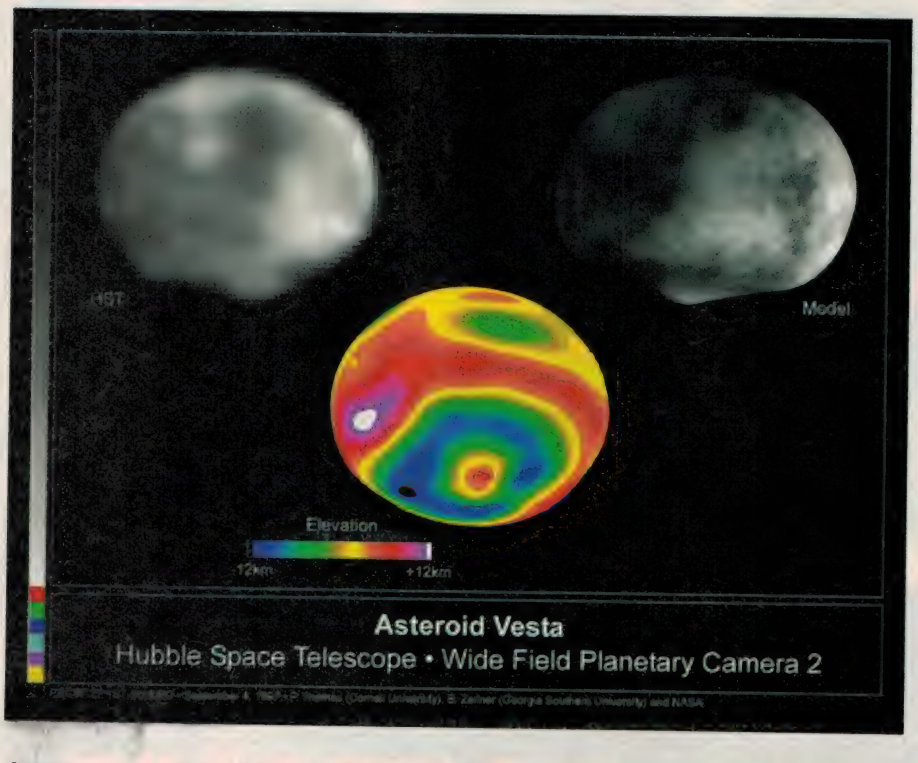
The contract is Foxboro's third major rail project in Hong Kong in the past three years. Paul Mansell, Foxboro's marketing manager, said the MTRC's 38 stations would be upgraded with new air conditioning and power control systems.

KOREA'S SAMSUNG ACQUIRES AST COMPUTER

US based PC and server supplier AST Research Inc. became a wholly owned subsidiary of Samsung Electronics Co. Ltd. of Seoul, South Korea on August 11. AST Australia Pty Ltd, which trades under the name AST Computer, is a subsidiary of the US company and is now also a subsidiary of Samsung Electronics Co. "The merger will provide AST with strong links to other divisions of Samsung Electronics and be particularly beneficial to us in the areas of research and development and the availability of key components used in the manufacture of personal computers," said Col Rennie, Director of Operations, Australia and New Zealand, AST Computer. "As a member of the Samsung Group of companies, with a collective US$87 billion in annual revenues during fiscal year 1996, AST will also gain financial stability and the ability to return to profitability and a stronger market position."

The success of the Australian build-to-order (BTO) operation at Silverwater, NSW, has led to two more BTO facilities being established in the Asian region, with strong emphasis being placed on the BTO function as a means of reducing order-to-delivery cycles and further improving customer service. Future desktop designs will employ a modular design to support this new build-to-order strategy.

AST Australia is based in Sydney and is currently celebrating 10 years in Australia. Information about AST and its products can be found on the World Wide Web at http://www.ast.com.



Astronomers using NASA's Hubble Space Telescope have discovered a huge impact crater on the asteroid 4 Vesta, nearly equal to Vesta's 330-mile diameter. Some of the smaller asteroids may have been formed from the impact that caused the crater.

FRENCH UPS FIRM SETS UP IN AUST

French firm Merlin Gerin Electronics (MGE), which claims to be the world's leading manufacturer of uninterruptible power supplies (UPSs), has established a subsidiary in Australia. Based in Meylan, France, the company has more than 35 years of worldwide accumulated experience and has a presence in more than 80 countries. It claims that its products are integrated with the largest computer and telecommunications companies in the world.

Before the establishment of MGE, internationally, Merlin Gerin was a division of the Schneider Electric Group. Since the mid 1980s the Company's UPS products, power conditioning products, related communications software and services have been available in Australia through Schneider/Merlin Gerin.

MGE provides power protection for a wide range of mission critical data needs, from large mainframes to midrange systems, PC networks and stand-alone PCs. Its products provide protection for computer data storage, medical, telecommunications, media, process control/manufacturing industries, and governments.

Apart from increasing its share of the Australian UPS business, which is being driven by the high growth computer industry, MGE is targeting burgeoning

opportunities in the IT, banking, building services, mining, oil & gas, telecommunication and power generating industries by integrating greater sophistication and protection.

MGE UPS Systems incorporate the Merlin Gerin UPS, Square D UPS, EPE and Topaz brands. The new local subsidiary is MGE-UPS Systems Australia Pty Ltd, and is found at Unit 14, Mina Court, 43-51 College Street, Gladesville 2111; phone (02) 9879 0755.

WINNERS OF FLUKE SCOPEMETERS

In the May, June and July 1997 issues, *Electronics Australia* and Philips Test & Measurement gave readers of the magazine the opportunity to win one of six Fluke 123 Industrial Scopemeters, simply by either taking a 12-month subscription to the magazine or extending their existing subscription for the same period. Each Scopemeter was valued at $1989 including tax, giving a total prize value of $11,934, and the winners were drawn on July 28, 1997.

We are very pleased to announce that these impressive instruments were won by the following six lucky subscribers:

Mr R.J. Noske, of Albury, NSW.

Mr L. Norgaard, of Yarraman, Qld.

Mr V. Edwards, of Altona, Vic.

Mr B. Reynolds, of Port Augusta West, SA.

Mr P. Bugden, of Glenhuntly, Vic.

Mr Garth, of Melville, WA.

Our congratulations to these winners, and our thanks to Philips Test & Measurement for their sponsorhip of this competition.

Siemens Ltd has provided $190,000 to sponsor The Siemens Science Experience for 1997/98, being held in September 1997 and January 1998. Designed to attract Year 9 students to careers in science and technology, the events are held at university campuses around Australia.

AAPT WINS VICONE ATM CONTRACT

AAPT, Australia's third largest long distance carrier, has won the VicOne ATM network contract, which is an integral part of the Victorian Government's Victoria 21 plan to make multimedia technology available to all Victorians. The Victorian Department of Education will be the first customer of VicOne, and will use the network to provide the state's schools with access to online services, multimedia and curriculum support.

AAPT, through its wholly owned subsidiary QNET Communications, has been awarded the contract to build, operate and manage the VicOne Network for a period of five years. The VicOne Network is based upon state of the art high speed ATM switching technology that is expected to support the requirements of the rapidly growing telecommunications and multimedia industry and the internet in both metropolitan and regional Victoria.

The network will involve 34 major points of presence and over 3000 access points, which will provide bandwidth of between 64kb/s and 34Mb/s and will be ATM and Frame Relay compatible. The 34 major nodes will also provide dial-up modem access.

"AAPT's strategic partnership with Cisco Systems gives us an end-to-end product delivered by the same hardware vendor, which is an Australian first in terms of an integrated network and management platform", said AAPT CEO Mr Larry Williams.

AAPT is 51% owned by AAP Information Services, in which News Limited and Fairfax are the major shareholders.

US-based communications system supplier Andrew Corporation is setting up a manufacturing plant in Suzhou, China. Due to begin production next October, the plant will make base station antennas, Heliax coaxial cable and other Andrew products.

TELECOM NZ TO TRIAL NEC ADSL TECHNOLOGY

Telecom New Zealand has awarded NEC Australia a contract to supply Asymmetric Digital Subscriber Line (ADSL) technology. In partnership with project managers Scollay Holdings of New Zealand, NEC will be providing ADSL technology for an in-house TNZ trial which will examine how ADSL may be used to deliver high quality television services and high speed internet access.

The trial is a first for New Zealand and involves the use of MPEG-2 video transport over existing copper cables using 7Mb/s ADSL modems based on chip sets supplied by GlobeSpan Technologies Inc.

NEC Australia has demonstrated ADSL technology at ATUG in Sydney, CEBIT in Germany, Supercomm in the USA, Telecom Asia in Singapore and at the TUANZ conference in New Zealand, where the advantages of the company's system were appreciated by telecommunication operators.

Adelaide college Westminster High has installed an Ericsson BusinessPhone 250 PABX system to allow provision of modern communications facilities such as integrated voicemail, video conferencing and computer telephony integration.

KEY MPEG-2 PATENT TO US FIRM FOUNDER

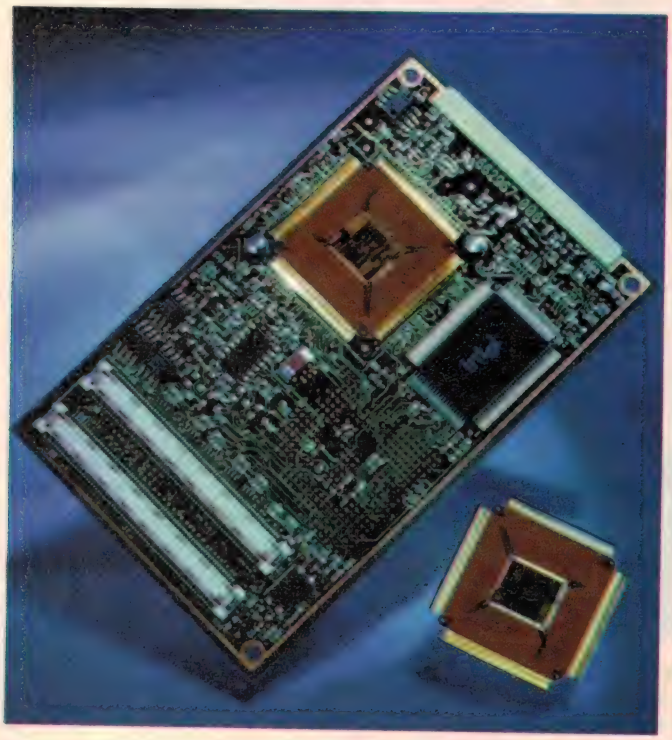
A key patent for television set-top boxes used in sending and/or receiving digital audio and video data, which has implications for networking, i.e. teleconferencing and Internet, as well as satellite TV, wireless cable, video games and security systems, plus personal and professional computers, has been assigned exclusively to InnovaCom, Inc., designer and developer of MPEG-2 single chip encoding integrated circuits, by its founder and chairman, Mark C. Koz.

The company said the patent, issued on July 1, 1997, was originally issued to Koz, who filed the patent in 1992, prior to the founding of the company.

International patent applications have been filed and currently are pending. Koz has assigned the patent to InnovaCom in exchange for one million shares of restricted common stock, valued at US$3 million.

"The patent, No 5,644,355, which is titled 'Adaptive Video Subscriber System', is enforceable on all digital video set-top boxes produced using multiple compression standards, including those designed for cable television decoding and for reception of DVB television signals. Because our set-top box patent was designed for multiple video compression standards, it represents the next generation of set-top boxes in the digital age. We believe the patent will generate substantial revenues because of its exclusivity", said Rand Shrader, InnovaCom's COO. "We expect to aggressively protect the company's rights under the patent."

During the past year Innovacomm has completed marketing agreements with, or designed MPEG-2 product configurations for firms such as Sun Microsystems, ESS Technology, Digital Equipment Corporation, Mitsubishi and Litton's Fibercom Division. (Business Wire)



Intel has recently released its 233MHz and 200MHz mobile Pentium processors with MMX, the first products built using the company's advanced 0.25-micron process technology.

RAY DOLBY WINS AEA'S 1997 MEDAL

Ray Dolby, founder and chairman of Dolby Laboratories Inc., was the 44th recipient of the American Electronic Association's coveted Medal of Achievement, presented at the association's annual meeting dinner in San Jose, California.

In noting the honour being given, George Sollman, 1997 AEA chairman and vice chairman of Centigram Communications Corp., said "Ray Dolby is a true entrepreneurial pioneer in the field of sound recording and reproduction. From the high-quality cassettes we play on our car stereos to the latest digital surround sound in movie theatres, we are constantly touched by the magic of this American inventor."

Previous Medal of Achievement recipients include William Hewlett and David Packard of Hewlett-Packard; Robert Noyce, Gordon Moore and Andrew Grove of Intel; Thomas J. Watson Jr. of IBM; Alexander M. Poniatoff of Ampex; and Robert Galvin of Motorola.

Earlier this year, Dolby was named a recipient of the US National Medal of Technology, received the IEEE's Masura Ibuka Consumer Electronics

Award and also received an honorary doctor of science degree from Cambridge University.

Dolby founded Dolby Laboratories Inc. in 1965, dedicated to the development of new audio noise-reduction techniques. Since then, consumers have purchased more than 630 million audio products licensed to use Dolby technologies. More than 7000 feature films have been released with Dolby-encoded soundtracks, and more than 43,000 cinemas worldwide have installed the equipment to play them.

OPTUS BECOMES C&W'S ASIA-PACIFIC FOCUS

Australia's Optus Communications, now majority owned by global carrier Cable & Wireless, is to become a major focus of C&W's Asia-Pacific strategy. As part of this change C&W's deputy chief executive and Chairman of its Asia Pacific Development Board, Mr Rod Olsen, will be relocating to Sydney in 1998. Optus has also appointed a new CEO, Mr Chris Anderson, who was previously Group Chief Executive of Television New Zealand.

In announcing the changes C&W Chief Executive Mr Richard Brown said "The changes are a clear signal that our operations in Australia and the whole Asia Pacific region have an important role to play in our future. Through its state-of-the-art networks and ability to offer a seamless and extensive range of communications products, Optus has built a business that complements our position as a world leader in integrated communications."

Optus has more than doubled the capacity of its Sydney-Melbourne optical fibre network this year, making it one of the largest commercial 10Gb/s transmission systems in the world. The system uses the latest optical transmission and amplification technology to support more than 120,000 simultaneous telephone calls on a single pair of fibres.

TAXI SERVICE WINS MOTOROLA RADIO AWARD

Motorola's Radio Products Group (RPG) has announced the winner of its 1997 Dispatch Solutions Award. Australian partnership KwikCab and Motorola dealer Sky-Comm outperformed the competition from the Asia Pacific region by winning the coveted gold award for an automated taxi-calling service using Motorola two-way radio technology.

KwikCab and Sky-Comm created an innovative solution to the common problem of flagging a taxi. Patented by KwikCab, trialled on the Gold Coast and soon to be launched in the United States and Asia, this ingenious cab-calling device is known as the 'Public Booking Terminal' or PBT. PBT relies upon Motorola two-way radio technology to automatically call a taxi, confirm the booking and print a confirmation within seconds — all for the price of one Australian dollar.

"The KwikCab System provides a high level of customer service due to Motorola's two-way radio technology that allows PBT to function with speed, efficiency and convenience", said Mr Andrew Chislett, Director of KwikCab. "This innovative system is highly cost effective, enabling KwikCab to eliminate the need for numerous dispatch operators. Additionally as there is no language barrier, PBT can be marketed around the world since taxis are found in every major metropolitan area", he said.

PBT is simple to use. A customer simply inserts a coin into the terminal and it automatically communicates the booking request to KwikCab's taxi host computer via the Motorola trunked radio system. Once the request is acknowledged, the booking and dispatch computer advises KwikCab's host computer which then communicates to PBT. A confirmation slip is then printed. The whole transaction normally takes between five and ten seconds.

TI LOSES IC PATENT RULING

The Tokyo High Court has upheld a lower court ruling in 1994 that Japan's Fujitsu had not infringed the 1958 IC patent held by Texas Instruments — the so-called 'Kilby Patent', named after TI engineer Jack Kilby, credited as co-inventor of the integrated circuit along with Intel's Robert Noyce. The court ruled that Fujitsu's chip designs differed significantly from TI's, and that therefore there was no infringement.

Spokespeople for Texas Instruments said that the company intends to contest the ruling in Japan's Supreme Court. TI Senior Vice President Richard Agnich said that his firm "is concerned that the ruling reflects a lack of respect in Japan for protecting important intellectual property".

Fujitsu was the first major Japanese company to contest the TI patent. Other Japanese firms like NEC, Matsushita, OKI and Toshiba pay TI large royalties, and TI had hoped to extract millions of dollars from Fujitsu before the patent expires in 2001. ❖

NEWS BRIEFS

- The 14th International Computer Exposition ***Computer '98*** will be held May 7-10, 1998 at the Hong Kong Convention and Exhibition Centre. For details contact Mr Louis Leung or Ms Joanne Li of Business and Industrial Trade Fairs Ltd, Unit 1223, HITEC, 1 Trademart Drive, Kowloon Bay, Hong Kong; phone (852) 2865 2633, fax (852) 2866 1770.
- The exhibition date and venue of The 6th International Computer Expo for China — Shanghai, ***Computer China '97 — Shanghai***, have been changed from November 5-8, 1997 at Shanghai Mart to December 3-6, 1997 at Shanghai International Exhibition Centre. More information can be obtained from the contact numbers listed above.
- Computronics International Pty Ltd is now called ***Computronic Corporation Ltd*** and has moved to 6 Sarich Way, Technology Park, Bentley 6102. The postal address is Locked Bag 20, Bentley Business Centre, WA 6983; phone (08) 9470 1177, fax (08) 9470 2844.
- ***EMC ASIA '97***, the first international exhibition with workshops on electromagnetic compatibility will be held at the Westin Stamford and Westin Plaza - Singapore, 4-6 November 1997. For more information contact Mesago, Messe & Kongress GmbH, password: EMC ASIA'97, Rotebuehlstrasse 83-85, D-70178 Stuttgart, Germany.
- Computer firm ***Fujitsu*** has moved to 2 Julius Avenue (cnr Delhi Road), North Ryde; phone (02) 9776 4555, fax (02) 9776 4556 (web **http://www.fujitsu.com.au**). ❖

Queensland Industry Feature:

GRIFFITH UNI'S IAP POWERS AHEAD

1997 has been another very successful year for Griffith University's innovative Industrial Affiliates Programme, in which final year undergraduate students in the School of Microelectronic Engineering work with both private and public organisations on important R&D projects. This year the students took part in some 28 projects.

Now in its sixth successful year, Griffith University's Industrial Affiliates Programme continues to meet all expectations. It was begun by Professor H. Barry Harrison, the Chair of Griffith's Engineering Board of Studies, who is justifiably proud of the way it has taken off.

The students, industry and Queensland technology all benefit from the IAP. The students gain 'real life' experience and are exposed to the most recent technologies and techniques in their particular field, while still continuing their formal studies. At the same time industry receives input from a highly trained microelectronics student who is committed to succeed, as well as the use of the University's extensive electronic resources.

Here are some of the latest crop of IAP success stories:

Dinosaur robot

A robotic Australian dinosaur could soon be prowling the corridors of the Queensland Museum, as the result of the work of microelectronics student Jason Adcock, who worked with two Swedish mechanical engineering students at the Museum on the reconstruction of a walking robotic dinosaur. This is the third year that the Queensland Museum has been an IAP partner.

Queensland Museum Electronics Supervisor Bill Brooker, said Jason and the two mechanical engineering students from Sweden had been working to develop an animated Minmi dinosaur. The Minmi had a body the size of a small cow or a large pig, with a thick tapering tail about two metres long and an extended neck.

"I believe this is the first time the Museum has been involved in an international partnership such as this", Mr Brooker said.

"The Minmi offers excellent scope for electronic and mechanical engineers to work together on a unique project, which must provide complex movement to enable the Minmi to walk on its four legs in a realistic manner and be powered by internal batteries."

Mr Brooker said Jason was an extremely motivated worker who had solved a lot of problems concerning the Minmi project.

"We started off with several options for the project, but now are confident of which path to take", he said.

"Jason successfully began the research to give us a starting point, designed the electronic control system which will operate the dinosaur's movements and developed a prototype. The model reconstruction is nearing completion and the final development is now up to the Museum."

"The IAP is invaluable in that it gives the students relevant work experience, often at the cutting edge of technology."

Voice mail add-on

Another IAP student has helped develop a system which enables voice mail to be added to old telephone systems. Steve Howard produced the MCI Interface while working for IAP partner firm The Communication Company, which was participating in the programme for the first time.

"In the past, voice mail suppliers had to walk away from telephone systems manufactured before 1992 because the function could not be integrated," according to Richard Zalewski from The Communication Company. "Steve has produced a commercially-viable PC-based product which will allow the introduction of voice mail. He has also been involved in the successful testing of the prototype."

Mr Zalewski said the Industrial Affiliates Programme had provided his

IAP students Norbert Schlick (L) and Tony Kwong (seated R), pictured working with EDMI's Gerry Weatherall on the current transducer for high voltage power lines.

company with access to extensive resources and expertise that would not normally be available. "If a problem arose during development of the product, Griffith University was there to back us up," he said.

"This was our first year with the IAP, but we will definitely be involved again and hope to offer students further work with our company."

Audio mixer module

Brisbane company Creative Audio, participating in the IAP for its fifth year, gave two of Griffith's engineering students the chance to 'mix it with the best' in the audio industry, and work on the development of a new professional audio product. Sam Court and Nicholas Davies were involved in the design of an RS-485 remote controlled mixer module for an existing amplifier.

Creative Audio Engineering Director, Neil Packer, said "It was their job to develop the hardware and software to improve upon the product and make it work. Sam and Nicholas have given our company a head start. The first prototype is basically complete and we will take it from there for a production prototype."

Australia Post's Queensland Engineering Manager Murray Dawson (L) with IAP student Alexander Resnikoff, who helped develop a logging system for Express Post box clearance.

Current transducer

The safety and efficiency of Queensland's high voltage power lines may soon be improved thanks to the work of microelectronics IAP students Siu Leung (Tony) Kwong and Norbert Schlick, who have been working at EDMI on the development of a current transducer. This is the first time EDMI has been an IAP partner.

Mr Gerry Weatherall from EDMI said the company had been so impressed with the students' work that they had offered Norbert employment after he graduated.

"From time to time, authorities in the electrical industry need to check and measure the current in high voltage power lines, both from efficiency and safety points of view," he said. "There are not a lot of devices around on the market which can successfully do this job, so we asked Norbert and Tony to evaluate different methods and make recommendations on how our company should tackle the problem."

"The students were able to provide us with some practical implementation guidelines and the project is now waiting on resources to enable development to go ahead."

Mail tracking

The Express Post service provided by Australia Post could soon be even more efficient, thanks to a Route Tracking System developed by IAP student Alexander Resnikoff who has been working for Australia Post on a key-activated system to log clearance of Express Post boxes. This is the fourth year Australia Post has been an IAP partner.

Murray Dawson, Manager Engineering for Australia Post Qld, said he was very happy with Alexander's achievements and the IAP.

"Our Express Post service offers guaranteed next business day delivery within the Express Post network," he said. "At the moment, our drivers register the time they empty an Express Post box by logging an electronic tag on the box door. This allows us to closely monitor the clearance of these boxes, ensuring we continue to honour our guarantee," he said.

"Alexander has developed a prototype of an electronic device which will log the clearance time when the driver inserts his key into the box lock. This will allow us to log box clearances even more efficiently. The control board still needs some work and we will have to miniaturise the key, but Alexander has given us a head start."

Medical data card

Two of Griffith's IAP students were involved in the development of a medical device with international market potential. Stephen Dingley and Jeff Smith have been working with a team of engineers from Micromedical Industries on the development of software for a medical card device. This is the second year Micromedical Industries has been a successful IAP partner.

Mr Andrew Loch from Micromedical Industries said both students had contributed significantly to the project, with Jeff staying on to work for the company.

"The project's aim was to build a prototype of a microprocessor-controlled medical device to record ECGs and enable transmission of that information to their award winning computer software systems," he said. "The students, under the guidance of our project leader, helped develop the functioning software version of the device which will have applications in various international markets."

"The major benefit to Micromedical Industries is that we have the first stage of the device. The students benefited by gaining practical experience, learning to comply with our procedures and understanding how to meet the regulatory requirements of ISO 9001 and European Community Medical Directive."

Companies and organisations in Queensland industry which are interested in joining the Griffith University School of Microelectronic Engineering's Industrial Affiliates Programme in 1998 should contact Programme Manager Carol-Joy Patrick, on (07) 3875 5007, or fax (07) 3975 6726. ❖

maxon in space

Swiss Precision DC Motors Give Mars Rover Legs

maxon
RE016 16mm

As the world watched the little "Sojourner" six-wheeled robot cautiously inch its way across the bleak Martian landscape, the driving force behind Pathfinder's dazzling success was Swiss precision engineering.

For each of the rover's six wheels was driven by a maxon RE016 16mm miniature DC motor from Interelectric AG. Four more were responsible for the vehicle's steering mechanism and the eleventh operated scientific equipment.

The US$100 maxon motors, with precious metal commutation and the patented CLL (Capacitor Long Life) concept, were adapted by the vehicle's manufacturer, Jet Propulsion Labs.

They were fitted with ball bearings at a total cost of US$220,000. maxon motors are found in a wide range of technically advanced applications, In fact anywhere a compact, high performance, low inertia drive is required. They are complemented with precision gearheads for a wide range of speeds and torques.

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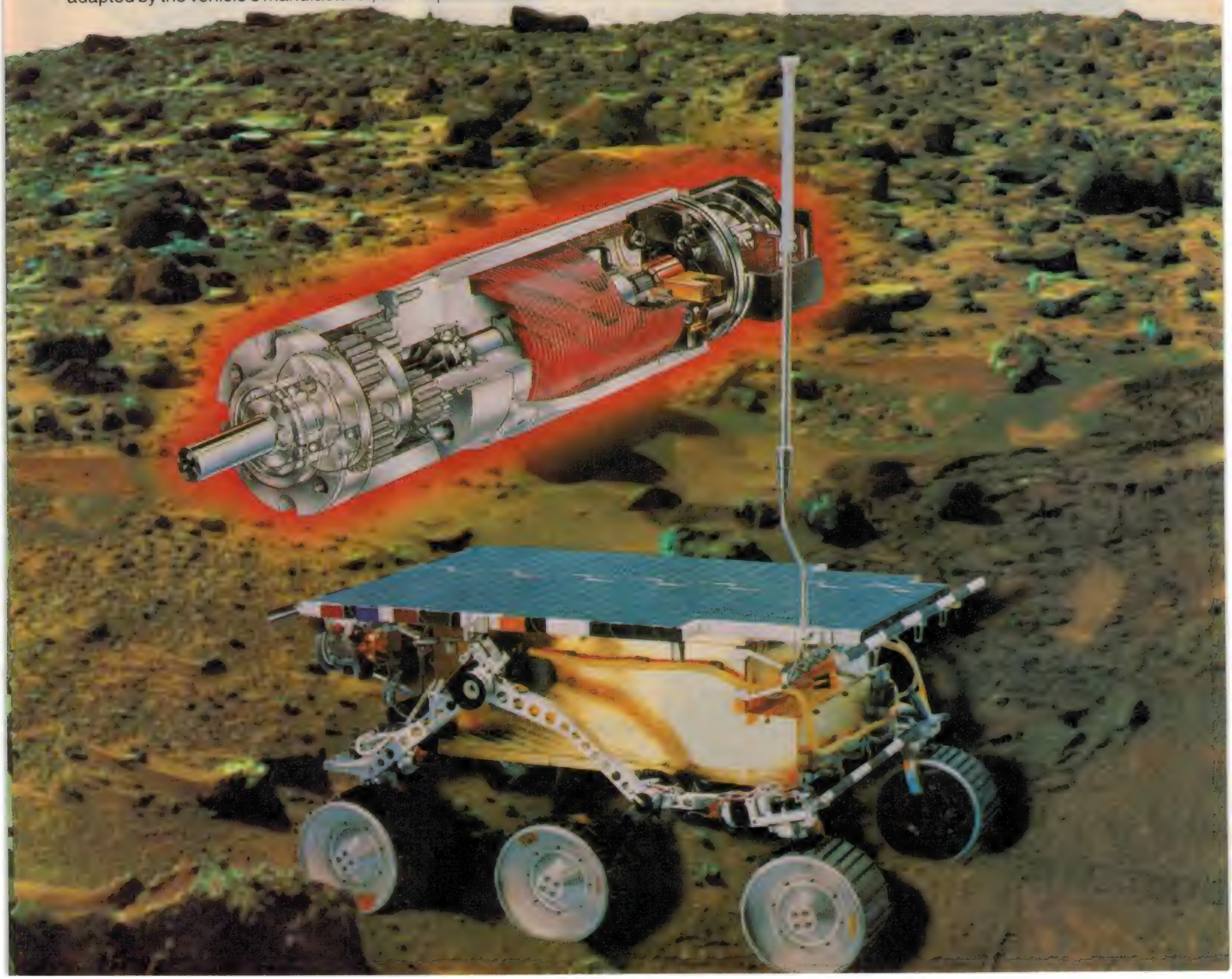


Queensland Industry Feature:

PRODUCTS & SERVICES

Here's just a sampling of the wide range of electronic products and services currently being offered by Queensland-based manufacturers, distributors and dealers...

Sinewave inverter

Bainbridge Technologies of Cleveland, which also trades as Statpower Australia, has just introduced its new Baintech 500W/12 Sinewave DC/AC Inverter. The unit is the result of many tests and approvals made by Bainbridge and its European suppliers, to ensure that they could supply an inverter capable of withstanding the high temperature and humidity conditions found in many areas of Australia. The unit was tested in far North Queensland in mid summer, and has proven to have outstanding reliability.

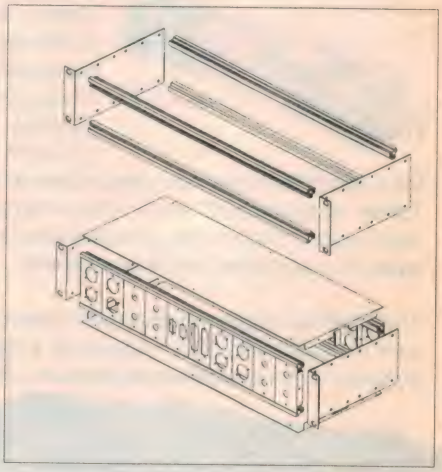
The inverter measures 346 x 218 x 90mm and is rated at 500 watts continuous, with a genuine surge rating of 1500W. It is 85% efficient and offers a true sinewave output waveform with the frequency stabilised to 50Hz +/-0.001% using a quartz crystal. The input battery voltage range is 12V +25%/-8%, and the output voltage regulation is rated at 230V +/-10% for a battery voltage of 13V. No-load consumption is less than 0.2A.

For further information contact Bainbridge Technologies at 77 Shore Street, Cleveland 4163; phone (07) 3821 3333 or fax (07) 3821 3977.

Modular metalwork

Cliff Electronics is distributing a new Modular Stage Box System called MSB. Rack panels, patch panels and stage boxes can be assembled to various dimensions without drilling, cutting or punching.

The basic elements of MSB are a pair



of end plates which lock in from one to 10 connector panels via aluminium extrusion. The connector panels are pre-drilled in 2U or 4U heights to take numerous industry standard connectors. All MSB parts are black powder coated and are assembled with self-tapping screws.

Further information is available from Cliff Electronics, PO Box 732 Fortitude Valley, 4006; phone (07) 3252 3178 or fax (07) 3252 3165. (E-mail **cliff@contal.net.au**, web site **http://www.contal.net.au**)

Microwave radio

Queensland based microwave technology specialist Mitec has seen a boom in sales for its new D-Series digital microwave radio, since Australia's telecommunications market deregulation in July. Product Manager Dick Carter says that the company expected orders to continue at the rate of at least 100 a month, and several million dollars worth of orders have been received to date.

Key users at present are the new Australian telecommunications companies and private network owners throughout Australia and overseas. An additional large market for the radios is expected to develop when television operators introduce digital transmission, Mr Carter said.

Key features of the D-Series include provision for easy upgrading, G.703 data rates ranging from 2Mb/s (E1) to 8.44Mb/s (E2) and 34.36Mb/s (E3), and the ability to operate on frequencies from 2GHz tp 13GHz.

Mitec is a leading global supplier of microwave technology, equipment and systems, with annual sales of over $20 million.

For more information contact Mitec Ltd on (07) 3291 6333.

Satellite TV

Bowen Hills based firm Nationwide Antenna Systems can supply receiving systems for the digital free-to-air satellite TV transmissions that are now available in Australia. Managing Director Geoff Dargie says his company has been flooded with requests for these systems, since the beginning of deregulation on July 1. The only equipment needed is a dish, downconverter, satellite receiver and interconnnecting cables, and viewers can watch programs from Japan, France, Germany, England, Portugal, Phillipines, Egypt, Italy, Spain and many other countries, 24 hours a day.

Signals are received from the two main satellites viewable from this part of the world, PanAmSat and Asiasat II. The European Bouquet (or package of programs) offers TV programs from France, Italy, Germany and Spain from the Asiasat II satellite, as well as radio programs. Because the programs are transmitted using digital technology the dish sizes have become smaller, resulting in more competitive prices.

Nationwide can supply a receiver about the same size as a VCR, and dishes ranging in size from 1.8m to 2.3m in diameter, depending on the program required and the strength of the transmitted signal. The average system starts at $1500 installed, and there is no further ongoing cost.

For further information contact Nationwide Antenna Systems, 17 Campbell Street, Bowen Hills 4006; phone (07) 3252 2947, or fax (07) 3252 8541.

Millennium bug help

Users of personal computers who wish to protect themselves against problems which may occur in their system at the beginning of the new century can get help from two products now available from Wynnum firm Computer Outlook 2000.

One product is CO 2000, a software testing program which checks that both the PC operating system and BIOS will return the year correctly — or not — in the rollover to year 2000. The software also reports the values held by the RTC/CMOS clock, the BIOS clock and the operating system clock, and allows the users to view RAM and RTC/CMOS contents directly. The CO 2000 test software is priced at $30 plus $6 for handling and postage.

The other product is the Millennium BIOS Board, a card which fits into a standard ISA slot and automatically instals itself into the first available area for BIOS extensions in the UMB, to provide full millennium compliance. The card is manufactured in the UK, with embedded software from BIOS maker American Megatrends Inc — but is compatible with all correctly designed BIOSes.

The Millennium BIOS Board is simple to install, even for inexperienced, non-technical users. The package includes clear and concise instructions, and is priced at $185 plus $7.50 for handling and postage.

Further information on both products is available from Computer Outlook 2000, PO Box 550, Wynnum 4178; phone freecall 1800 640131 or freefax 1800 640181. ❖

A very logical prize!

TOTAL PRIZE VALUE
$7,910

HEWLETT® PACKARD

Hurry!

Win one of 7 HP LogicDarts

Electronics Australia and Hewlett-Packard are giving away 7 HP LogicDarts valued at $1,130 each. _Total Prize Value $7,910._

The HP LogicDart is an advanced logic probe that not only performs basic logic monitoring and analysis, but also tests continuity and measures frequency and dc voltage, eliminating the hassle of switching tools and keeping you focused on solving problems. It's the perfect tool for first-level troubleshooting.

Features include:
* Single probe to make required measurements.
* Precise probe tip which allows you to probe fine-pitch surface mount circuitry.

How to enter:
Simply subscribe or renew your subscription to *Electronics Australia* for the discount price of only $49, (saving you $22.40 on the normal cover price) and you will receive automatic entry into the draw to win one of these seven Hewlett-Packard LogicDarts.

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Conditions of Entry. 1. The competition is open to Australian residents authorising a new or renewed subscription to *Electronics Australia*. Employees of the Hannan Group, Hewlett-Packard, their subsidiaries and families are not eliible to enter. 2. Prizes are not transferable or exchangeable and may not be converted to cash. 3. The judge's decision is final and no correspondence will be entered into. 4. The competition commences on October 13, 1997, and closes last mail on January 20, 1998. 5. The draw is at the promoter's premises on February 3, 1998 at 11am and the winners will be announced in the May 1998 issue of Electronics Australia, on sale April 23, 1998, and notified by mail. 6. The prize is one of seven Hewlett-Packard LogicDarts, valued at $1,130 each. Total prize value is $7,910. 7. Subscriptions are not refundable. 8. The promoter is the Federal Publishing Company, 180 Bourke Rd, Alexandria, NSW 2015. 9. All entries become the property of Federal Publishing, and may be used for future marketing purposes. NSW Permit No. TC97/7023; ACT Permit No. TP97/0658; NT Permit No. NT/97/pending; SA Permit No. T6831. VIC Permit No. pending.

Offer Ends January 20, 1998

Queensland Industry Feature:

QLD SUPPLIERS & MANUFACTURERS

To assist our readers in identifying, locating and contacting suppliers and manufacturers based in Queensland, here is a listing showing each firm's address and contact details plus a summary of their main products and services:

Aurum Plating Electronics

Phone/fax (07) 3888 0256. Contact Luis Gomez.
Aurum manufactures PCB prototypes and also performs gold plating to specification. All jobs are NC routed with solder mask and overlay.

Bainbridge Technologies

PO Box 33, Cleveland 4163. Phone (07) 3821 3333, fax (07) 3821 3977. Contact: Ron F. Heindorff, MD.
Bainbridge Technologies manufactures and markets the Statpower range of power supplies and inverters. The firm has just added the Baintech 500W sinewave inverter to its range, following extensive in-house testing to prove its high reliability in the high temperature and high humidity conditions demanded by Australian users.

Baltec Systems

9/87 Webster Road, Stafford 4053. Phone (07) 3356 8111, fax (07) 3356 8777. Contact: Brett Riddell or Karen Guinea.
Baltec Systems is an ISO9001 certified company which specialises in control systems and electrical engineering in a diverse range of projects for clients in the heavy engineering and industrial process sectors.

Campad Electronics

PO Box 269, Capalaba, 4157. Phone (07) 3245 2008. Contact: Paul Alick.
Services include R&D for industrial electronics; protection of pool, spa and irrigation pumps; power supplies (both linear and switch mode); servicing and repair of electronic equipment and kits.

Cliff Electronics (Aust)

34c Chester Street (PO Box 732), Fortitude Valley 4006. Phone (07) 3252 3178, fax (07) 3252 3165. (Web site http://www.contal.net.au/cliff, email cliff@contal.net.au) Contact: Paul Montague.
Cliff Electronics offers the Cliff Components range of audio hardware, complemented by a wide range of electronic hardware and test equipment from Fluke, Black Star, AEMC, Kepco and others. It also supplies Penn Fabrication Flight Case Hardware.

Computer Outlook 2000 Pty Ltd

PO Box 550, Wynnum 4178. Phone (07) 3348 5666, fax (07) 3348 5777 (freecall 1800 640131, freefax 1800 640181). Contact: Bill Benham.
Computer Outlook 2000 specialises in millenium bug compliance. It can supply the CO2000 Test Disk and the Millenium BIOS Board, for upgrading non-compliant PCs for the Y2K hardware problem.

Delsound

1 Wickham Terrace (cnr Ann and Wharf Sts), Brisbane 4000. Phone (07) 3839 6155, fax (07) 3832 5278. Contact: Trevor Dellit.
Delsound was established in 1970 as a supplier of sound, intercom and video

READER INFO NO.23

systems. Since then it has expanded considerably to become a major importer and supplier of electronic parts and components, computer accessories, sound and intercom systems (both hire/install), and communications equipment.

Griffith University

Industrial Affiliates Program, School of Microelectronic Engineering, Faculty of Engineering, Griffith University 4111. Phone (07) 3875 5007, fax (07) 3875 6726. Contact: Carol-joy Patrick.

Industry's avenue to research and design solutions, from concept to prototype. Final-year students work on industry projects in this highly acclaimed industry/university program. Taking projects for 1998 now!

Mitec Ltd

532 Seventeen Mile Rocks Road, Sinnamon Park, 4073. Phone (07) 3291 6333, fax (07) 3291 6350. Contact: Tony Reading.

Mitec is the Australian microwave technology company. It designs, manufactures and supplies microwave links, SSPAs, satcom converters, video links, frequency converters and L-band electronically steered mobile satellite communications antennas. The company is ISO9001 accredited and is listed on the Australian Stock Exchange with 140 staff in three locations.

Nationwide Antenna Systems

17 Campbell Street, Bowen Hills 4006. Phone (07) 3252 2947, fax (07) 3252 8541. Contact: Geoff Dargie.

Nationwide has been a wholesale supplier of TV aerials and satellite receiving systems since 1981. The company provides products and services for both domestic and commercial installations, as well as full technical backup.

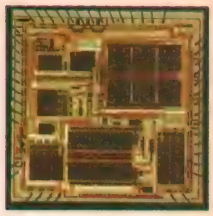
Precision Power

Unit 6, 72 Riverside Place, Morningside 4170. Phone (07) 3395 7433, fax (07) 3395 6650, freecall 008 777 446. Contact: John Wedgwood.

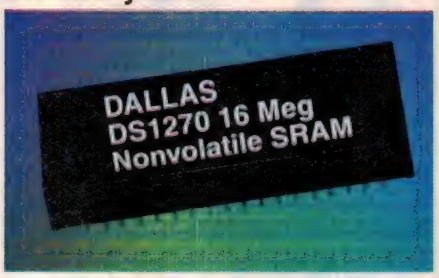
Queensland-based manufacturer and importer of power conditioning products, incorporating the 'Islatrol' active tracking suppressor range of filters. Has offices in South-East Asia. ❖

Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY...



SRAM holds data for five years

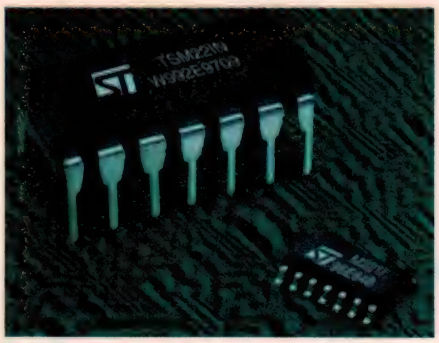


Dallas Semiconductor has released the DS1270, a 2M x 8 non-volatile SRAM module. Built using four low power 4Mb SRAMs, it is a high density, high performance non-volatile memory that retains data for more than five years in the absence of external power. The module features 70ns access times for reads and writes, and unlimited write endurance.

The device is claimed to serve applications that other technologies such as Flash memory do not. Applications include telecommunications, networking, file servers, and data acquisition. Other features include commercial and industrial temperature ranges, standard non-multiplexed SRAM interface, and a 150uA standby current.

For further information circle 271 on the reader service coupon or contact Dallas Semiconductor, 4401 S. Beltwood Parkway, Dallas, TX 75244-3292; phone +(972) 371 4448 (web site **http://www.dalsemi.com**).

Multi-purpose analog IC



The latest addition to the SGS-Thomson Microelectronics range of linear ICs is the TSM221. Designed as a general purpose low voltage analog block for automotive, telecom and consumer applications, the device provides two independent rail-to-rail op-amps and two independent comparators housed in a 14-pin DIP or surface mount SO package.

The IC operates from a single supply from 2.7V to 16V, takes a supply current of 500uA (total package at 5V) and is fully immune to latch-up. The two op-amps feature rail-to-rail operation at both input and output and an input bias current of 1pA. With a 1MHz typical gain-bandwidth product, they are specified for a 600Ω load.

The comparators have push-pull output stages (don't need external pull-up resistors), and also feature a 1pA typical input bias current and input offset current. The input common mode range includes ground, and the typical response time for a 5mV overdrive is 2us.

For further information circle 277 on the reader service coupon or contact SGS-Thomson Microelectronics, Suite 3, Level 7, 43 Bridge Street Hurstville 2220; phone (02) 9580 3811.

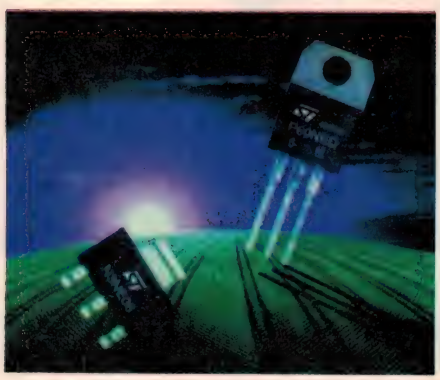
2.3GHz GaAs FETs

Mitsubishi Electric has added three new devices to its MGF0900 series of N-channel Schottky gate GaAs FETs for UHF power amplifier applications. The devices are the MGF0909A, MGF0910A and the MGF0911A 2.3GHz GaAs FETs. The MGF0909A has a power gain at 2.3GHz of 11dB for 20dBm power input. Power output is typically 38dBm. The MGF0910A has the same power capabilities for class A operation.

The MGF0911A, in a larger package, is also a class A operation device and has an output power of 41dBm (typ) and a power gain of 11dB. All devices in the series come hermetically sealed in metal ceramic packaging with ceramic lids.

For further information circle 276 on the reader service coupon or contact Mitsubishi Electric, 348 Victoria Road, Rydalmere 2116; phone (02) 9684 7777.

Power MOSFETs with low on-resistance



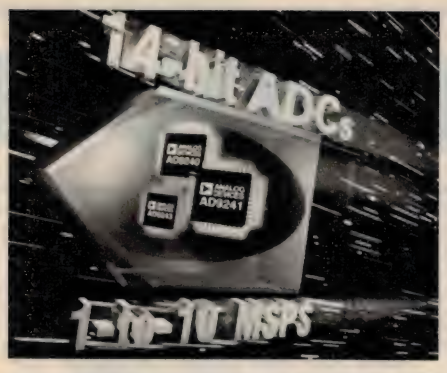
SGS-Thomson Microelectronics has introduced a family of low voltage power MOSFETs said to have many advantages over conventional cellular power MOSFETs. Known as the NE series, the new devices are claimed to feature a very low on-resistance and exceptionally high dV/dt capability. Applications include mobile phones, laptop energy management systems, UPS and DC motor controls, and other uses where the dV/dt capability of the body-drain diode is important.

The devices feature a single size process, which is based on a strip layout technique developed by SGS-Thomson. Conventional power MOSFET processes are critically dependent on three cell dimensions.

The initial product range includes 30V and 60V N-channel enhancement mode devices, with on-resistance values from 120mΩ to 10mΩ.The dV/dt capability of the body-drain diode, which is crucial in bridge topologies, is now specified in the datasheets. For example, the STN3NE06 is rated at 15V/ns, with a simultaneous di/dt stress of 500A/us.

For further information circle 274 on the reader service coupon or contact SGS-Thomson Microelectronics, Suite 3, Level 7, 43 Bridge Street, Hurstville 2220; phone (02) 9580 3811.

10MS/s 14-bit ADC



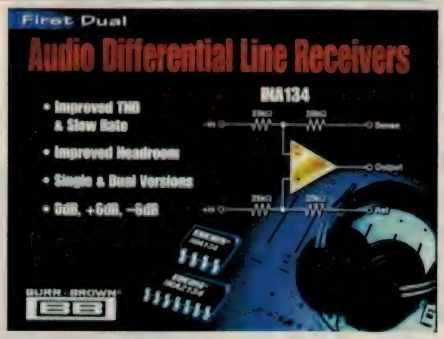
Analog Devices has introduced a family of CMOS analog-to-digital converters (ADCs) claimed to set new industry benchmarks for high sample rates and low power consumption for 14-bit ADCs. The pin-compatible AD9240 (10MS/s), the AD9241 (1.25MS/s), and the AD9243 (3MS/s) are said to be the first 14-bit monolithic ADCs to break the 1MS/s sample rate barrier.

Each member of the AD924x family features single-supply operation, an internal reference, an on-chip sample-hold amplifier, and true differential inputs. Other specifications include a power dissipation from 65mW to 285mW, single +5V supply operation, and a typical SFDR (spurious free dynamic range) of up to 91dB.

The ADCs have a flexible input structure which can accommodate both single-ended and differential peak-to-peak inputs to 5V. They are packaged in a 44-pin MQFP.

For further information circle 280 on the reader service coupon or contact Analog Devices, PO Box 98, West Rosebud 3940; phone (059) 86 7755 (Web site: **http://www.analog.com**).

Audio differential line receiver op-amp

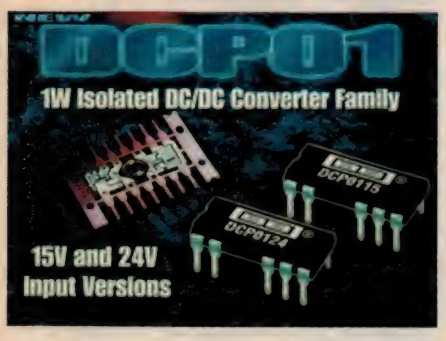


Burr-Brown's new INA134 and INA137 families are differential line receivers consisting of high performance op-amps with on-chip precision resistors. They feature balanced line inputs for audio signals which require high noise rejection and low distortion. Both devices are available in single and dual versions.

Specifications include 0.0005% distortion at 1kHz, 90dB common-mode rejection, 3us overload recovery, a quiescent current of 2.9mA, and a slew rate of 14V/us. The devices are said to provide superior performance in professional audio systems including recording studio equipment, radio/TV and sound reinforcement equipment. The INA134 and INA2134 provide 0dB gain (G = 1), and the INA137 and INA2137 provide +/-6dB (G = 1/2 or G = 2). The dual versions feature independent circuitry to prevent crosstalk when one op-amp is overloaded or overdriven. The on-chip resistors are laser trimmed for accurate gain and optimum common-mode rejection, and operation is guaranteed from +/-4V to +/-18V.

For further information circle 275 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 9878 2700.

1W DC/DC converter ICs



Burr-Brown's new DCP0115 and DCP0124 families are high efficiency, 15V and 24V input isolated DC/DC converters featuring a 1W (nominal), galvanically isolated output power capability. The devices also feature thermal shutdown and overload protection via watchdog circuitry. The devices are claimed to be able to start up to full power output with any capacitive load, and have advanced power-on reset facilities.

Key specifications include: 93 million hours MTBF, 3.8mm profile, self or external synchronisation, indefinite short circuit protection, 400kHz switching, and 1000V RMS isolation. They are suitable for a wide variety of industrial applications including point-of-use power conversion, ground loop elimination, data acquisition, industrial control and instrumentation, and test equipment. Both products are packaged in a 14-pin plastic DIP.

For further information circle 273 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 9878 2700. ❖

NEW PRODUCTS

DMM plus current loop calibrator

Fluke has introduced the Fluke 787 ProcessMeter, a digital multimeter and a current-loop calibrator in a single handheld tool. The instrument has a DC current measurement accuracy of 0.05% with a resolution of 1uA. It is claimed to be a complete, cost effective solution for troubleshooting and calibrating current-loop instrumentation.

The instrument has the core capabilities of the Fluke 87, Category III, 1000V digital multimeter, plus the ability to source DC current and perform loop calibrations. Its capabilities include measurement of AC and DC volts, AC and DC current, resistance, continuity, and frequency; sourcing and simulation of up to 24mA of DC loop current; and true RMS AC voltage measurement to 1kHz. It also has a touch-hold capability that retains a reading after the probes are disconnected and a backlit LCD that displays 4000 counts for voltage measurement and 30,000 counts for DC current.

For further information circle 241 on the reader service coupon or contact GEC Electronics Division, Unit 1, 38 South Street, Rydalmere 2116.

Tests high capacity lead-acid batteries

The new Hioki HiTester model 3551 is designed to test high capacity lead-acid batteries of greater than 500Ah capacity, without interrupting the operation, such as in a UPS in mainframe computer installations. Measurements made by the instrument include internal cell resistance (resolution of one micro ohm), cell voltage and temperature (using the optional 9640 lead and clip with temperature sensor).

Comparator circuitry provides up to 99 operator selectable criteria for pass, warning and fail LED indications. The individual comparator values are based on combinations of low and high voltage, and cell resistance thresholds. The instrument is especially suitable for testing sealed batteries where measuring electrolyte specific gravity is not possible.

For further information circle 248 on the reader service coupon or contact Nilsen Technologies, 150 Oxford Street, Collingwood 3066.

115.2kb/s RS-232/485 converters

Dataforth's new LDM2485A/B series of high speed, RS-232 to RS-485 interface converters are said to turn PCs, terminals and other RS-232 devices into powerful RS-485 workstations. Both models conform to the EIA RS-485 standard and are signal powered.

Operating asynchronously over two or four wires, at data rates up to 115.2kb/s, the converters let RS-232 machines 'talk' with up to 50 addressable devices in a multi-point polling environment. Distances of up to 1.5km are possible at lower data rates, and the converters have 600W of built-in silicon avalanche diode surge protection.

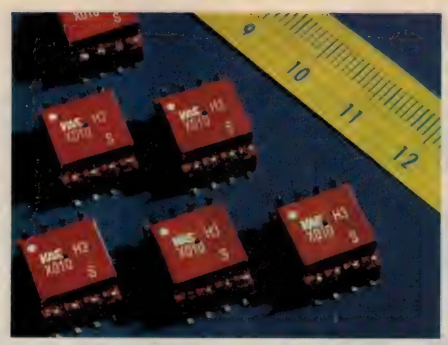
Configuration parameters include carrier control, RTS/CTS delay, receive impedance, transmit-off impedance, and echo, so the converters can be fine tuned to demanding multi-point applications.

For further information circle 244 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130.

Compact So hybrid module for ISDN

The So hybrid module, developed by Vacuumschmelze, is available in Australia and New Zealand from Siemens. The module can be used in all ISDN devices and systems equipped with one or several So terminals. It contains two So transformers and a current compensated four-way choke and all other passive components such as diodes, resistors and capacitors needed

to set up a complete So terminal. The module complies with all CCITT.I.430 requirements and can be used in all types of terminal equipment, private branch exchanges and network termination devices.



For further information circle 242 on the reader service coupon or contact Advanced Information Products, Siemens Ltd, 544 Church Street, Richmond 3121.

IR LED illuminators

A range of light emitting diode (LED) infrared illuminators is now available from Allthings Sales & Services. Included are a fully built commercial unit, kits and pre-assembled kits. The illuminators are for use with IR sensitive monochrome video cameras, for observing sick people in low light conditions, or studying birds, animals, fish, insects etc.

The illuminators range from 48 to 210 infrared LEDs, with a maximum power input of 44W. Spectral output is from 770 to 1025 nanometres in four bands; visible radiation varies from a dull glow to barely perceptible and radiation angles are 22, 24, 50 or 60 degrees.

For further information circle 249 on the reader service coupon or contact Allthings Sales & Services, PO Box 25, Westminster 6061; phone (09) 349 9413. ❖

Power Supplies and Conditioners Feature:

UPSONIC'S PS-MS300 COMPACT 300VA UPS

The PS-MS300 is the smallest of Upsonic's current range of uninterruptible power supplies, and is surprisingly compact. Despite this it offers output voltage regulation, a Novell-compatible port to advise a computer's operating system when the mains power has failed, and the ability to power a typical PC system for over 15 minutes — more than enough to allow you to save crucial data and negotiate an orderly shutdown.

by JIM ROWE

Manufacturers of uninterruptible power supply (UPS) units seem to have been taking lessons from the IC chip makers, because each new range of models seems to be smaller than the last. This certainly seems to be the case with the latest range from Upsonic, judging from the very compact PS-MS300 unit. It measures only 187 x 173 x 103mm, and weighs a modest 4.7kg — making it much smaller and lighter than models of similar rating only a few years back.

One of the factors contributing to this size reduction seems to have been the adoption of microcontroller-based circuitry, allowing a significant reduction in the UPS electronics. Another factor seems to have been a significant increase in inverter efficiency, allowing the use of a smaller battery. Together these factors seem to have made it possible to achieve not only a UPS of reduced size, but one offering more features into the bargain.

In the case of the PS-MS300, for example, these extra features include automatic testing and self-diagnosis; the ability to signal a mains failure to external equipment (such as a PC), via a built-in RS-232C serial port; automatic overload detection; and automatic protection against brownouts and over-voltage mains transients. Many of these features have been available in the past, but only as 'optional extras'.

Another nice feature of the PS-MS300 is a built-in EMI filter, to reduce noise emissions. Like most power supply or conditioner units using switch-mode operation for high electrical efficiency, traditional UPSs have been fairly 'noisy', but the PS-MS300 and its larger brothers have the CE rating for electromagnetic compatibility.

The output rating of the PS-MS300 is 300VA/200W, which is sufficient to power a typical modern PC and video monitor combination. It uses a sealed lead-acid battery, and in the event of a mains failure or droop in mains voltage to below 85% of normal, it switches over to battery-inverter power in typically 4.6 milliseconds — around a quarter of a mains cycle, at 50Hz. In other words, there is essentially no significant interruption to power during the switchover.

Incidentally the PS-MS300 and its larger brothers incorporate automatic detection of incoming mains frequency (50/60Hz), and 'mirror' this in their output during battery operation. They also detect any rise of the mains voltage above 120% of the nominal value, and again swing over to battery/inverter operation. This is in addition to the suppression of short mains transient 'spikes'.

The inverter output during battery operation is of the 'modified sinewave' type, consisting of bipolar rectangular pulses with brief gaps between them.

Upsonic PS-MS300 Personal UPS

A 'line interactive, semi-intelligent' standby uninterruptible power supply of nominal 300VA rating, suitable for typical PC systems.

Good points: Very compact, yet more than sufficient capacity to allow data saving and PC system closedown in the event of a power failure or brownout. Good status indication via LEDs and beeper; built in serial port for automatic software control. Attractively priced.

Bad points: Nothing serious. Faint smell of heated metal during autonomous (battery) mode, at least when new.

RRP: $275 alone, or $329 with PowerMon II software for most popular PCs.

Available: From computer dealers. Further information from Upsonic Power Pty Ltd, Unit 1, Block C Slough Business Park, Janine Street Scoresby 3179; phone 1800 634 307 or fax 1800 634 308 (e-mail **upsales@iaccess.com.au**).

Most equipment is quite happy with this kind of waveform, as a substitute for the normal mains sinewave. Which is handy, because inverters designed to produce this type of output tend to be significantly more efficient than those producing a true sinewave. The rated efficiency of the PS-MS300 is 90% when delivering its rated output.

The rated hold-up or 'autonomy' time for the PS-MS300 is 15 minutes, by the way, when supplying a load drawing 271VA or 145W. When used with a typical computer system (the most likely application for this type of UPS), this would of course allow plenty of time to save one's working data and close down any applications, etc.

On the front of the PS-MS300 there are no less than five indicator LEDs, which provide a surprising amount of useful status information. On the left is a 'Normal' green LED, which either glows continuously to indicate the presence of mains power, or blinks when the battery is being recharged; then there's an orange 'Autonomy' LED, which blinks when the mains has failed and the load power is being supplied by the battery. The third LED indicates 'Overload' in either mains or battery operation; the fourth LED is the 'Battery Low' indicator, signalling when the battery is nearly exhausted; and finally the fifth LED is the 'Fault' indicator, which warns of a failure in the inverter circuitry. (Other faults can cause some of the other LEDs to flash.)

When the PS-MS300 detects a mains failure or some other fault condition requiring switchover to battery power, it sounds a beeper as well as flashing the 'Autonomy' LED, to alert you of the need to begin a planned closedown. Which is fine, of course — but what if the PC or other load happens to be running unattended, like a network server or BBS machine? It's here that the UPS's inbuilt serial port plays its role, by allowing the unit to advise the PC operating system of the situation so that it can perform an automatic closedown routine.

With the PS-MS300 and its larger brothers the serial port not only allows the UPS to advise the PC of its status (both power failure and low battery condition), but also allows the PC in turn to command the UPS to shut off the power, after making backups and closing down the applications. This allows conservation of UPS battery energy. The UPS automatically restores the output power when the mains recovers, by the way.

To allow users to take maximum advantage of these capabilities, Upsonic can supply compatible 'Powermon II Shutdown Software' in versions to suit a wide range of computers. As well as versions to suit the popular IBM compatibles with Windows 95, NT4, OS/2 or Win 3.1X, there are also versions to suit Apple Macs, Silicon Graphics workstations and machines running Unix, Xenix, AIX, HP-UX or DEC VMS. There's also a version for use with Novell netware, for use in LAN servers. The Powermon II software has apparently been written for Upsonic by Systems Enhancement Corporation.

Probably the best news of all about the PS-MS300 is the price. It carries an RRP of only $275, or $329 bundled with the Win 3.X, Win 95, NT4 or Novell versions of the PowerMon II software. Very reasonable indeed, by any standards.

Trying one out

We were able to test a sample PS-MS300 unit with a typical modern office PC — a Pentium 133MHz machine fitted with 3.5" and 5.25" floppy drives, 2.6GB hard drive and 6X CD-ROM drive, together with a 17" multiscan colour monitor, external 28.8kb/s modem and a small flatbed scanner. The estimated total power drain of the system was around 270W, according to the individual specifications.

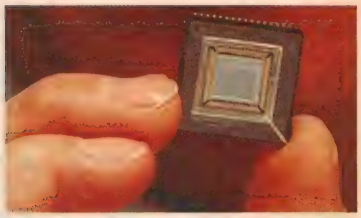
The main parameter we checked was how long the unit would 'hold up' this system in the event of a mains failure, before the 'Low Battery' LED began blinking. This was done a number of times, but with the unit allowed to charge up its battery properly between tests, to make them realistic (and fair). We allowed 10 hours for each recharging, as stated in the UPS specs. We also tried accessing the computer's hard and floppy drives quite a few times *during* each test, to simulate more closely a typical 'closing down' sequence.

The holdup time turned out to vary between 16 and 17 minutes, which we found quite impressive from such a compact unit. It's also more than sufficient time to allow anyone to save their data, back out of their applications and close down the system — which is what you'd do in practice, rather than keep working until the battery was near exhaustion.

Each time we performed the test, the computer kept on working without the faintest suggestion of a mains interruption; the only indication of changed conditions was the onset of a gentle beeping from the PS-MS300, the flashing of its 'Autonomy' LED, and a faint smell of heated metal from within the (still very new) UPS itself.

Overall we were most impressed with the PS-MS300, which despite its tiny size seems to have plenty of capacity to provide power failure and brownout protection for a typical modern PC. This plus its very reasonable price should make it almost an essential 'peripheral' for any serious home or office computer user. ❖

Silicon Valley NEWSLETTER



Intel's new 0.25um laptop processors

Intel has launched the first of a new generation of microprocessors produced with a new 0.25 micron production process. The two MMX-based, 200MHz and 233MHz chips are designed for the fast-growing portable computer market.

The chips will bridge some of the performance gap between Windows PCs and Apple's popular PowerBook computers, which feature top speed of up to 250MHz. More importantly, the so-called 'Tillamook' processors may alter the power structure in the portable PC market, as they provide key new opportunities for system manufacturers hoping to compete with the market leaders.

The chips will enable portable computer makers to design systems that will retail for between US$2500 and $7000, depending on configuration. Several dozen system houses have already announced new portable computers based on the Tillamook chips, or said they are close to releasing such machines.

According to Giga Information Group, a San Jose market research company, portable computer sales are growing at about 30% a year, twice the level of traditional desktop machines. "More and more workers are being unplugged from their desk", said Ron Enderie, a senior analyst at Giga. "Intel is making a concerted effort to ensure that portable systems match desktop system performance."

Motorola to use Kopin's tiny display

Motorola and Kopin Corporation have announced a major agreement that will let Motorola incorporate Kopin's revolutionary CyberDisplay cellular telephone display into some of its cellular telephones. The tiny CyberDisplay allows users to view an entire Web page or read a full page e-mail or fax page, by peering into the device which is attached to the bottom of a cellular smart phone.

Kopin has spent 12 years and more than US$100 million developing the display, which is about a size of a grain of rice (0.28" in diameter) but appears full size when users look through the lens.

Industry analysts said they were unclear what the technology means for the future of the cellular market. "It could turn into nothing, or in 10 years be a standard feature", said Dataquest analyst Martin Reynolds. "This device is so interesting it could just turn into something else nobody has thought of yet."

The CyberDisplay looks like a camcorder's viewfinder. At the bottom sits a tiny LCD display. Being just an inch away from the eye, the 1/4" display appears as large as a 10" computer screen. The technology allows users to simultaneously look at information on the display and talk on the phone.

'Super laser gun' might be tested...

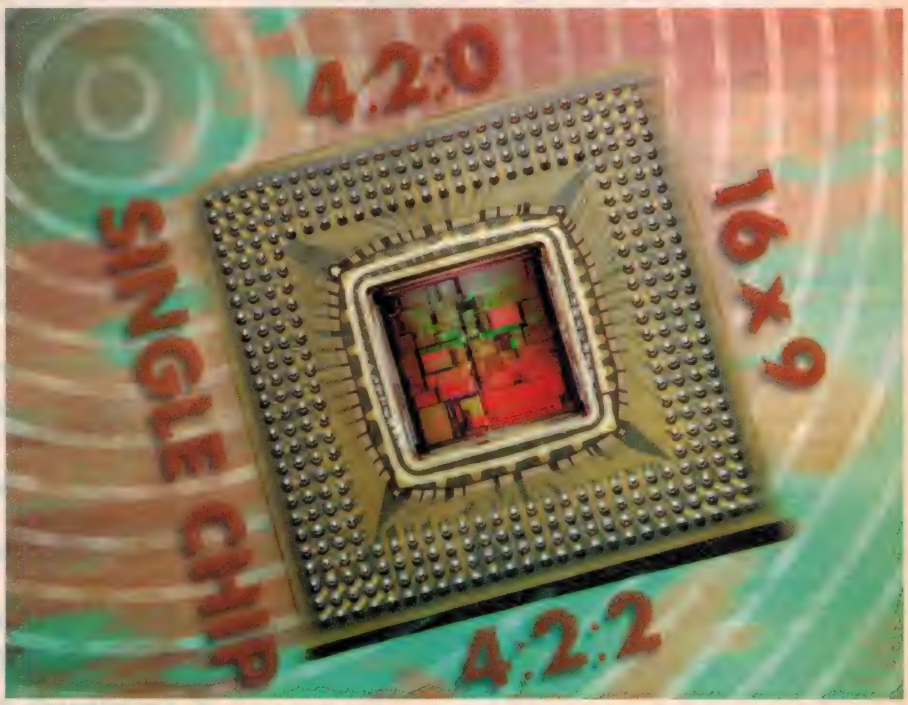
Some time in September, the US Army was planning to fire a high-energy laser beam, measuring six feet in diameter, at a US Air Force satellite orbiting the earth. If successful, the beam, originating from the White Sands Missile Range in the New Mexico desert, was expected to destroy the satellite.

Although the test would not break any arms treaties, it required approval from President Clinton. Some analysts believed Clinton would rule against the test for political reasons, as the US does not want to set off a arms race in space. If successful, however, the weapon, one of the few surviving elements of President Reagan's Star Wars program, would provide the US with a capability to knock out enemy spy and communications satellites in time of war.

Skeptics say the deployment of the gun will set of a race to develop new satellites that will be able to withstand a laser attack from the ground.

The gun, named 'Miracl' for Mid-Infrared Advanced Chemical Laser, was built by Spectrum Astro of Gilbert in Arizona. It cost US$60 million to build the facility that houses the gun.

Miracl has been test-fired in the 1980s by the US Army in tests on ground targets, speeding drone airplanes and rockets in flight. The US was prohibited by treaty to test fire the gun at an actual



C-Cube's new DVx chip, claimed as the first single-chip codec (coder and decoder) for MPEG-2 digital video streams. It's expected to allow a dramatic drop in the cost of professional video editing systems, and in the long run also lower the cost of consumer products like set-top boxes and DVD players.

satellite until 1995, when Congress let the ban expire.

The Miracl gun works by burning a mixture of fuels and then extracting the energy with mirrors. The resulting laser beam has as energy level equal to millions of watts of power. Despite the dissipation of some of that energy over a trajectory of several hundred miles, there remains enough power to destroy targets with the intense heat.

C-Cube first with single digital video chip

Currently, a minimum of three chips are required to let PCs, DVDs and other devices record and play back video images in a digital format. But now C-Cube Microsystems of Milpitas in Silicon Valley has developed the first single MPEG-2 chip capable of performing the chore.

The inexpensive chip will enable manufacturers to develop more compact, less expensive systems such as future record/play DVDs, satellite TVs, digital cable TV set-top boxes and video cameras. While C-Cube is the first, other companies, including IBM and Intel are said to be developing similar components for the digital video systems market.

"C-Cube is the only company who has shown me working silicon", said Dale Ford, senior industry analyst at market researcher Dataquest. "What's exciting to me is the potential this holds in two or three years."

"This will create brand new markets in consumer electronics", said Alex Balkanski, C-Cube chief executive. The first products, aimed at professional video editing and broadcasting markets, could appear in early 1998, he said.

FTC to examine Intel-Chips merger

The US Federal Trade Commission is reportedly looking into possible antitrust implications of Intel's planned acquisition of Chips & Technologies, and has asked both companies to provide detailed background information including product development, and market strategies.

The US$420 million deal would provide Intel with Chips' line of graphics controller chips, key components in today's multimedia computers. The merger will enable Intel to integrate the market's leading graphics controllers with the industry's dominating line of microprocessors. Such an integration could make it more difficult for both manufacturers of Intel-compatible microprocessors and Chips' graphics controllers to compete with Intel in either market.

S3 is one of the companies said to have asked the FTC to either block the deal, or get assurances from Intel that it will not move to overwhelm the other competitors in the graphics chips market. Ron Yara, an S3 co-founder, said his company would have a hard time competing with Intel if the companies ties sales of its microprocessors to the graphics line. "We can compete successfully as long as the playing field is level."

At Intel, company officials have been down-playing the threat their company would wipe out the competition in the graphics chip market. "We are not particularly interested in cornering the graphics chip market. What we're interested in doing is moving the personal computer platform forward. If some other graphics company does that instead of Intel, we'll be equally happy. We intend to make sure that doesn't change our relationship with other manufacturers at all," said Stephen Nachtsheim, vice president of Intel's handheld products group.

ITC finds firms dumped supercomputers

The US International Trade Commission has found that Japan's NEC and Fujitsu have been dumping supercomputers in the US market. The agency also said it will look into charges that four companies, including Taiwan's Winbond, are infringing on CD-ROM controller chips used in the disk drives sold in the United States.

The ITC finding is expected to prompt the Commerce Department to implement steep anti-dumping duties of 454% NEC supercomputers and 150% on future Fujitsu super systems shipped to customers in the United States. The finding did not come as a surprise, as it follows a preliminary finding in March that the two firms had been dumping supercomputers.

The government's action is the outcome of a complaint filed last July by Cray Research, after NEC won a contract for weather forecasting computers with the National Center for Atmospheric Research in Boulder, Colorado. Cray said the US$35 million price on NEC's system was less than one-fourth of their fair market value, while NEC maintains that the price included a profit margin. The ITS is siding with Cray's argument that NEC and Fujitsu are not including expenses related to the development costs into their price.

At NEC, executive Yukio Mizuno said the tariffs will force the company to stop marketing its systems in the US. "The ones who will be most hurt by this anti-dumping case are the American research institutes who use supercomputers", Mizuno said — adding that NEC's computers are better than Cray's at performing highly complex weather simulations for studying changes in the global climate.

Cray, a subsidiary of Silicon Graphics, controls 60% of the world supercomputer market and has had little competition in the United States. ❖

Intel's Grove sees Internet commerce 'exploding'

On the Internet a tiny backroom vendor will be able to put up the same flashy electronic fronts as the biggest companies, creating vast new business opportunities for entrepreneurs who will be able to market their ideas, products and services worldwide, said Andy Grove, chairman of Intel. "Nobody knows you're a dog on the Internet", Grove quipped. "Business transactions will be conducted not face to face, but screen to screen", he added in the keynote address of the industry conference in Orlando. "What I see ahead of us is a period of change even broader than the one we've seen, and it will be from connectivity,"

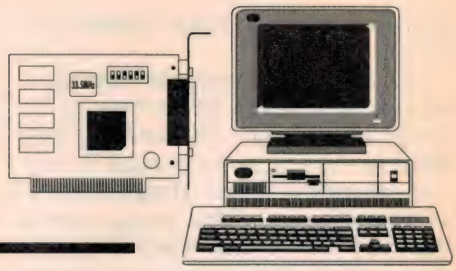
Currently some 200 million to 250 million computers worldwide are now linked, including those of an estimated 80 million American users of the Internet. The number is increasing rapidly and may approach one billion or more within a few years.

The effects on retailing and business in general from networked computers will be "as great as the introduction of the telephone in the United States, only 10 times faster", Grove predicted. "What took decades with the telephone will take only the same number of years now."

Market researchers predict that Internet commerce will skyrocket from about US$8 billion in 1997 to $200 - 300 billion by 2002.

At the conference, Intel and SAP, the Germany-based fourth largest software company in the world, announced they have formed a joint venture called Pandesic to sell computers, software and support services to small and medium sized companies wanting to sell on the Internet. Pandesic software will automate the process of taking orders through the Internet, coordinate the orders and shipping, monitor inventory within a business or with its suppliers, and track accounts receivables. The first Pandesic software was to be launched by September 30 in the United States and in 1998 elsewhere.

Computer News and New Products



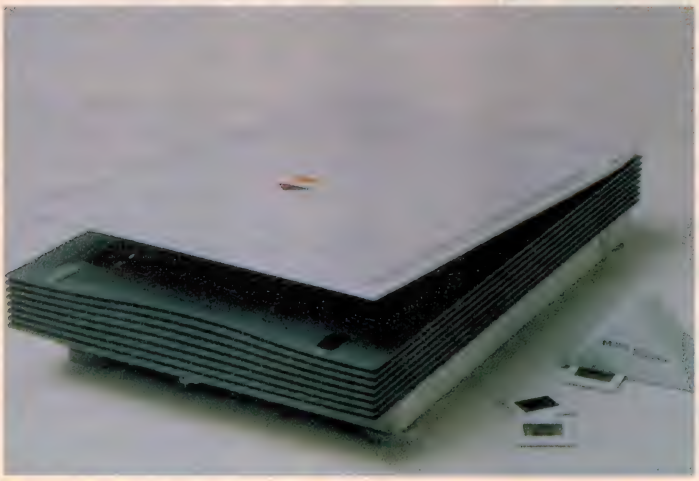
17" monitor with 21" features

Hitachi Australia has announced the availability in Australia of the CM630, a 17" computer monitor with features normally found in the company's higher priced 21" models such as the CM803. It has a resolution to 1280 x 1024, an 85Hz refresh rate, and has been designed specifically for Windows 95 and Macintosh systems.

It also has an 86kHz horizontal scanning frequency and a flat-square screen with double beam focus and anti-static AR coating for glare reduction. The 0.22mm dot pitch is claimed as one of the smallest available in a 17" monitor. It has a digital on-screen setup and save system with 42 modes that can be configured by the user. Controls include those for pincushion, pin balance and parallelogram, not normally found in 17" monitors at this price. The monitor is available from major computer retailers around Australia for an estimated street price of $1590 including tax.

For further information circle 164 on the reader service coupon or contact Hitachi Australia Ltd, 13-15 Lyonpark Road, North Ryde 2113; phone (02) 9888 4100.

Pro quality scanner



Hewlett-Packard has introduced the HP ScanJet 6100C professional series scanner family, a colour/greyscale flatbed scanner, expected to sell for about $1335 including sales tax. The scanner features HP's Intelligent Scanning Technology, claimed to give superior image-scanning quality, and comes with a 35mm slide adaptor and a comprehensive range of software.

Included in the software is Adobe Acrobat 3.0 for Internet use, Corel Web.Graphics Suite (for Windows only), Caere OmniPage limited edition OCR software with HP AccuPage technology, Corel Photo-Paint for Windows or Adobe Photoshop LE for Macintosh, and the HP ScanJet Copy Utility for photo copying from the desktop.

Accessories include a 50-page automatic document feeder, for scanning multiple pages up to 210 by 356mm (estimated price $613) and a transparency adaptor that can scan 35mm and other transparent media of up to 210 by 297mm (around $699).

For further information phone the HP Customer Information Centre on 131347. See also HP's scanner specific Web site at **www.hp/go/scanjet**

Mouse for Internet users

The new Genius NetMouse is designed for the Internet enthusiast. It features a middle button which is said to do away with task bars in all Windows-based programs. This button is claimed to increase productivity by allowing the user, either left or right handed, to press down on its top or bottom section and scroll up or down with maximum control of the speed.

The mouse is compatible with any application which works under Windows 3.1x, '95 and Microsoft Office 97. It features a control panel which allows the user to customise the various functions, including browsing speed and direction. It also incorporates a 'button find' feature that automatically positions the cursor on the default button in Windows programs.

For further information circle 166 on the reader service coupon or contact Milyn Imports and Genius Australia, 4 Briar Court, Fulham Gardens, SA 5024; phone (08) 8235 2388. Web site **http://milyn.in-sa.com.au/**

Computer includes colour scanner

Hewlett-Packard has announced the second generation of its family of HP Pavilion PCs. These redesigned home PCs come with an Intel Pentium processor with MMX technology, a built-in full-colour scanner, a new level of PC sound quality from Polk Audio and a one touch multimedia keyboard. The PCs also feature a three-toned colour scheme.

The multimedia keyboard has an inbuilt volume control and additional shortcut keys to launch programs or access Web sites. The detachable Polk Audio speakers and a subwoofer are claimed to deliver a rich, high-quality sound.

Other features include an Intel Pentium processor of up to 233MHz with MMX technology; 3D graphics on all models; 56kb/s fax-data modem; 24X CD-ROM; and up to 6GB hard drive. The computers come pre-installed with a special collection of imaging software. Also included in the Pavilion 8155P model is a built-in PhotoDrive full colour scanner, placed below the CD-ROM drive.

For further information phone the HP Customer Information Centre on 131347. Information about HP products is on the World Wide Web at **http://www.hp.com**.

56K fax/modem has SVD capabilities

The recently released Spirit 560SP is voice and data-fax modem with speaker-phone and simultaneous voice over data (SVD) capabilities. The release date was timed to coincide with the introduction of 56K facilities by major Australian Internet service providers, possible only if a service provider upgrades to a direct digital connection.

The new modem has full duplex speaker-phone capabilities for two way conversation and comes with a headset/microphone. Because users can speak over the top of a modem data connection, the SVD function allows video conferencing, software support and game playing with remote opponents.

The software supplied with the modem allows it to be used as a conventional answering machine, and the fax function enables users to send and receive faxes while running other applications. The RRP of the modem is $269 (internal version $229), and is available from computer and department stores across Australia.

For further information circle 161 on the reader service coupon or contact Mike Boorne Electronics, PO Box 8, Turramurra 2074; phone (02) 9906 6666. Web site **www.spiritmodems.com.au**

Video editing card upgrade

Miro has released the new Mirovideo DC30 plus, replacing the previous version, the DC30. The key hardware improvement is its ability to digitise video at an even lower compression rate than its predecessor, (2.5:1 for NTSC or 3:1 for PAL), with a constant data rate up to 7MB/sec, at full S-video resolution.

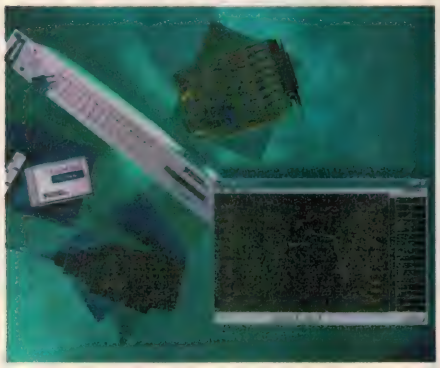
The upgraded software acts as a plug-in for the full version of Adobe's editing software Premiere V4.2, which is now included in the package. The new hardware and software are claimed to give intelligent rendering, optimised usage of hard disk space and multiple file playback abilities. For example, the new software playback technology allows the video editor to produce high quality videos up to an hour long. The RRP of the card is $2150 (incl tax).

For further information circle 165 on the reader service coupon or contact Lako Vision, 2/3 Wellington Street, Kew 3101; phone (03) 9852 7444, Web site **http://www.lakovision.com.au**

Card for temperature measurements

National Instruments has announced a new line of precision plug-in boards designed specifically for temperature measurements with thermocouples, RTDs and thermistors. The DAQMeter 4350 family features 5-1/2 digit measurements, low-noise design, and precision current excitation for high-accuracy thermocouple, RTD, and thermistor measurements. It has a +/-15V input range so it can measure other low-bandwidth analog signals.

The family includes the DAQCard 4350 for PCMCIA based notebook computers and the PC-4350 for ISA PCs.



They come with the company's NI-DAQ driver software for Windows NT/95, VirtualBench Logger turnkey virtual instrumentation software, and an instrument driver. Both products are compatible with the company's LabVIEW, BridgeVIEW, LabWindows/CVI, ComponentWorks, and Measure virtual instrumentation software products.

For further information circle 167 on the reader service coupon or contact National Instruments Australia, PO Box 466, Ringwood 3134; phone (03) 9879 5166. Website at **http://www.natinst.com/**

17" variable scan industrial monitors

Intecolor has released a new range of 17" variable scan industrial monitors. The monitors scan from 30kHz to 69kHz and have a resolution from 640 x 480 to 1024 x 768, and a 0.27mm dot pitch CRT which has anti-static protection and a low ELF/VLF emissions yoke. They also have on-screen digital control for all screen adjustments, dynamic focus and a high contrast invar shadow mask CRT.

The sturdy MIL 217 design is claimed to ensure reliability in three-shift operations, and the rugged chassis can withstand 1G in all axes. The auto-switching power supply adjusts to all worldwide supply voltages and frequencies. Enclosure designs include rack and panel mount, with options for auto-tracking, power factor correction, touch screens and magnetic shields. They have an MTBF of over 60,000 hours at 25°C.

For further information circle 160 on the reader service coupon or contact Intelligent Systems Australia, PO Box 118, Berwick 3806; phone (03) 9796 2290. Internet site at **http://www.intelsys.com.au.**

Protel PCB software upgrade

Protel International has released Advanced PCB 3.1 — a major upgrade of the company's PCB design software. Over 25 new features have been included, giving the user greater control over rule creation and checking. Rule violations are reported online and there are more options to customise the visual interface, including a user-definable right mouse click pop-up menu. A wide range of Version 2 style editing commands are back by popular demand, and increased feedback is given by the generation of new reports.

Performance has been improved, with an increase in speed and greater capacity of editing actions. Large sections can be moved, pasted from a clipboard, and the undo/redo command has been optimised for large editing actions involving thousands of primitives. As well, nearly 60 other issues relating to Advanced PCB 3.0 have been resolved.

The RRP of the program is $2995; users with earlier versions should visit **www.protel.com** for current upgrade offers.

For further information circle 162 on the reader service coupon or contact Protel International, PO Box 427, Frenchs Forest 2086; phone (02) 9975 7710.

WEBWATCH

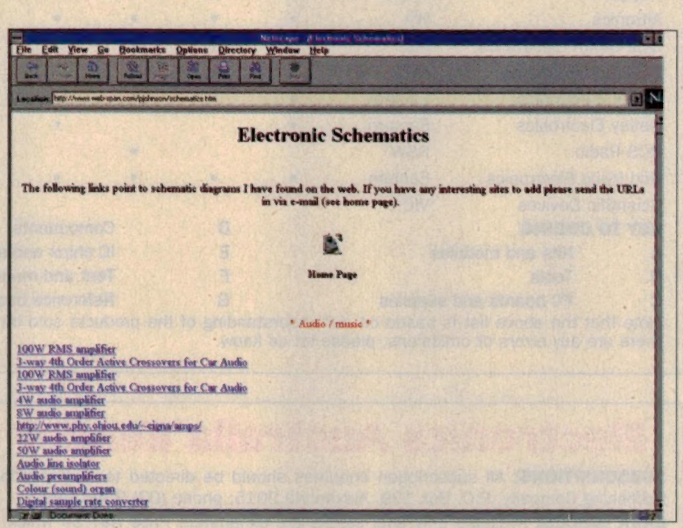
presented by GRAHAM CATTLEY

Electronic Schematics

http://www.web-span.com/pjohnson/schematics.htm

This is actually a sub page of Peter Johnson's home page, situated in Hobart, Tasmania. Peter has a number of interesting links on his home page, but it's his Electronic Schematics link page that will probably appeal most to *EA* readers.

Over 200 circuit diagrams, scattered across sites all over the world are referenced here, and they are all sorted into a number of categories. If you are looking for a circuit, you are more than likely to find it here, with information on building anything from a flashing LED through to an X-ray machine. The schematics vary from simple ASCII drawings through to complete projects including scanned-in diagrams, photographs and construction details.

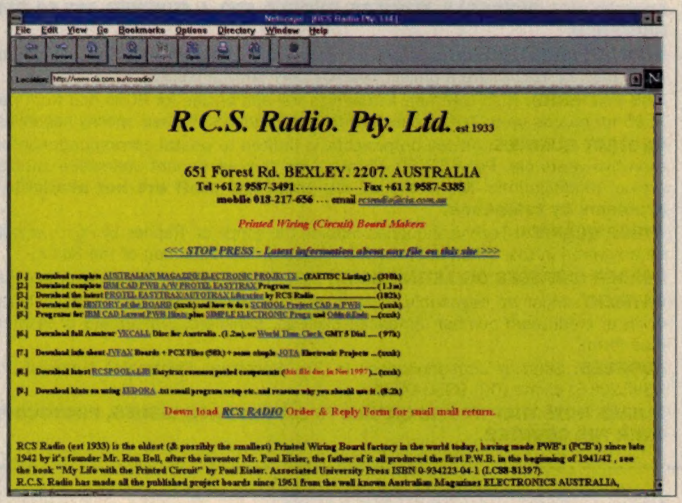


RCS Radio's site

http://www.cia.com.au/rcsradio/

If you are a regular reader of *EA*, you have no doubt heard of RCS Radio. It's one of the few companies that makes circuit boards for every project we've published since 1961. Founded in 1933 by the late Ron Bell, RCS Radio has been manufacturing circuit boards (or Printed Wiring Boards, as they're strictly known) since 1942, and they make all the PCBs published in Australia by a number of different magazines.

These days RCS is run by Bob Barnes, and this site reflects his inimitable style. On it you'll find a selection of free downloadable software, including the ever popular Easytrax. You'll also find a a number of text files where Bob has passed on his vast experience in designing and making printed circuit boards. There's hints and tips on using Easytrax, as well as a number of different component libraries designed by Bob to help you with your design. If you are thinking of making your own boards, or want to know some of the history behind PCBs, this should be your first stop.

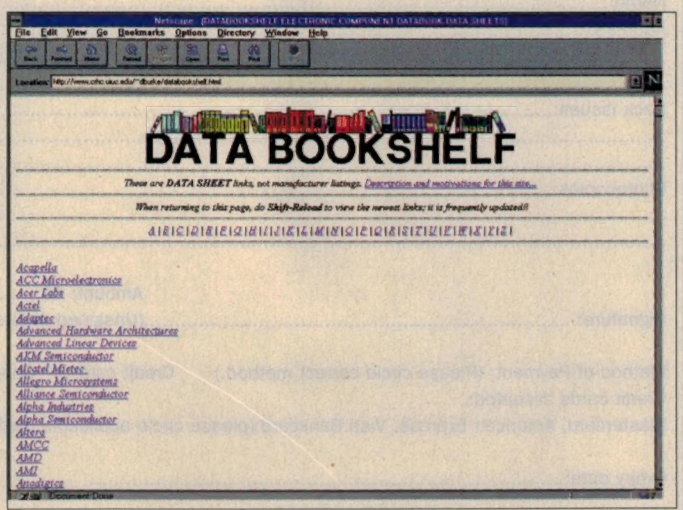


Data Bookshelf

http://www.crhc.uiuc.edu/~dburke/databookshelf.html

Dan Burke, System Engineer and senior research programmer at the Center for Reliable and High Performance Computing in Illinois, maintains this site as a handy launching-off point to a number of useful electronics sites. The data bookshelf itself is a list of a couple of hundred semiconductor manufacturer and electronics industry sites, with each link taking you directly to the technical data and bypassing the usual corporate information and advertising you usually have to wade through. The page seems to be kept reasonably up to date, and Dan asks for feedback regarding new sites, or address changes.

The other links include: InfoQuick, a well executed data sheet repository; TDS-NET, a data sheet archive with search engine; and the AT&T Toll Free Components Directory. ❖



Many readers have written in to say that the Chip Directory site described in the September issue has moved. The simplest way to find the site closest to you is to try the main index page at: **http://www.hitex.com/chipdir/index.htm**, which lists all the mirror sites of the Chip Directory on the web.

Come across any good sites that you think other EA readers would be interested in? If so, feel free to let us know — our email address is **electaus@magna.com.au.**

EA DIRECTORY OF SUPPLIERS

Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also, some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

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KEY TO CODING

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Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

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PCB PATTERNS: High contrast, actual size transparencies for PCBs and front panels are available. Price is $5 for boards up to 100sq.cm, $10 for larger boards. Please specify negatives or positives.

PROJECT QUERIES: Advice on projects is limited to postal correspondence only and to projects less than five years old. Price $7.50. Please note that we cannot undertake special research or advise on project modifications. **Members of our technical staff are not available to discuss technical problems by telephone.**

OTHER QUERIES: Technical queries outside the scope of 'Replies by Post', or submitted without fee, may be answered in the 'Information Centre' pages at the discretion of the Editor.

READER SERVICES BULLETIN BOARD: (02) 9353 0627; ANSI, 24 hour access; any rate to 28.8kb/s.

PAYMENT: Must be negotiable in Australia and payable to Electronics Australia. Send cheque, money order or credit card number (American Express, Bankcard, Mastercard or Visa card), name and address (see form).

ADDRESS: Send all correspondence to: The Secretary, Electronics Australia, P.O. Box 199, Alexandria NSW 2015; phone (02) 9353 0620.

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ADVERTISING INDEX

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EDUCATIONAL ROBOTIC ARM KIT

NEW

Coming soon. This inexpensive kit gives an introduction to experimental robotics, with all mechanical components, including the three servos and software disk included. This exciting low cost kit take only around half an hour to assemble. Soon to be described in Silicon Chip magazine.

NEW SEMICONDUCTORS

- 2SK2175 — MOSFETs 15A, TO220, 60V, 30W: **10 for $15**
- CA3140 — MOSFET I/P opamp: **5 for $5**
- TL494 — switchmode power supply IC: **5 for $5**
- NE555 — timer IC: **10 for $5**
- ICL7106 — LCD display driver: **$5**
- ICL7107 — LED display driver: **$5**
- IRFZ44 MOSFETS: 60V, 0.028 ohm on-resistance, 50A: **10 for $3**
- C8050 & C8550 transistor **20** for **$5**
- CMOS ICs 4001. 11, 13, 16, 17, 20, 24, 28, 40, 46, 60, 66, 69, 93: Any mixture: **10 for $8**

SUPER BRIGHT BLUE LEDS

BY FAR THE BRIGHTEST BLUE EVER OFFERED, super bright at 400mCd: **$1.50** ea or **10 for $10**

5mm LEDS AT SUPER PRICES

- 1Cd red: **10 for $4**
- 300mCd green: **$1.10** ea. or **10 for $7** (*make white light by mixing the output of red green and blue*)
- 3Cd red: **$1.10** ea. or **10 for $7**
- 3Cd yellow (small torch!) also available in 3mm: **10 for $9**
- Super bright flashing LEDs: **$1.50** ea. or **10 for $10**

NEW COMPUTER CONTROLLED STEPPER MOTOR KIT

Similar to our previous stepper motor kit but with improvements so larger motors can be driven more efficiently, with much reduced loading on the computer's parallel port, and 2.5KV opto-isolation between the stepper driving circuit and the computer. Previous purchasers: contact us for a simple modification to greatly reduce the loading on the computer's parallel port. PCB and all on board components kit plus software and information: **$39** or with two M35 motors: **$49**

CCD IMAGE SENSOR

High quality "Thomson" brand, 576x550 pixels with antiblooming, with full data but no circuit suggestions, usable response from 400 to 1100nm, 30dB S/N at 40 milli-lux, 2/3" optics compatible format: **$35**

COLOUR MONITOR

New 12V DC-1A 6" colour monitor, no case, just the tube and driver PCBs, RGB inputs (some info might be available): **$65**

VERY EFFICIENT WHITE LIGHT - LCD DISPLAY

Brand new "second grade" (few missing pixels) Sharp 640x480 LCD display (LM64P722) with a very efficient "state of the art" cold cathode BL fluorescent lamp (5mm dia, 150mm long) which is very easy to remove! Produces useful white light at about 1-3W AC input! Lamp has a 10,000hr life! Removing the display reveals a uniformly lit 150 x 200mm backplane. Complete display plus BL inverter kit (needs 12V/150mA): **$17** Data sheets (11 pages) for a similar display: **$2**

CALLER ID

See the phone number of your incoming calls on an LCD screen while the phone is ringing. Has 80 call memory, dialler etc. Approved units available soon. Around **$50**!

BEST VALUE CCD CAMERA

The best "value for money" CCD camera on the market! Tiny CCD camera, 0.1 lux, IR responsive, high resolution. This camera has a metal lens housing (not plastic) and performs better than many cheaper models. No surcharge for credit card orders! A pinhole lens version also available for the same price: **$105**

COLOUR CCD CAMERA - NEW

This high quality CCD camera is built over 3 boards which are joined with a flexible cable that can be folded into a very compact camera. Head board: 42x20.5mm, lens height: 24mm. Main board: 42x42x9mm. Power board 42x20.5x8.8mm. ***SPECIAL Introductory price:*** **$350**, less with sales tax exemption. *Note:* A higher resolution colour CCD camera is also available. Ring for details.

KITS FOR CCD CAMERA SECURITY

New INTERFACE KIT FOR TIME LAPSE RECORDING: now has relay contact outputs! Can be directly connected to a VCR or via a learning remote control: **$25** for PCB and all on-board components, used PIR to suit: **$12**.

- **32mm 10 LED IR ILLUMINATOR** new IR (880nm) LEDs have an output about equal to our old 42 LED IR illuminator: **$14.**
- **32mm AUDIO PREAMPLIFIER** An **$8** kit that produces a 'line level' signal from an electret microphone, connect the output to our:
- **UHF VIDEO TRANSMITTER** (**$30**) or **$20** when bought with the camera. for a complete Audio-Video link.

32mm AUDIO AMPLIFIER: An LM380 based **$9** audio power amplifier which can directly drive a speaker — needs the 32mm preamplifier. *WHAT IS 32mm?* All boards are 32mm dia, so you can house these kits in a plastic 32mm joiner: cheap plumbing part.

BARGAIN CORNER

See our Web site or poll (02) 9570 7910 for "Bargain Corner" and "New Products". Web site has much much more info, including a catalog.

BARGAIN ARGON LASER HEADS

Cheapest way to get a BLUE-GREEN LASER beam! These used argons have around 30mW output (may need a licence), 6 mth guarantee. Power supply based on a transformer with 80V @ 2A and 3V @ 20A secondaries. Ring or email for more info. Head only: **$250**.

AUDIO - VIDEO MONITOR

2ch compact high res 5" screen B/W audio and video monitor. 12V DC 1A. Monitor and 6-way mini input connector only: **$125**

AMPLIFIER - PREAMP AND MORE

A professional mostly SMD PCB with a 5W amplifier based on a TDA1905 IC, and a separate audio preamp. We also include a prewired high quality unidirectional electret mic with wind filter and mounting clip, a small speaker and hook up info. Probably from a communications system. Great for many applications such as a two way intercom that doesn't require switching (needs 2). Less than the cost of the mic! **$15 ea, 2 for $24**

LASER ENGINE

New complete laser engine as used in laser printers. Includes a polygon scanner motor with xtal controlled driver PCB, 5mW/780nm laser diode in collimated housing mirrors/mirrors lenses, and info to make motor & laser operational. Bargain **$35**

SOLAR REGULATOR

Ref: EA Nov/Dec 94 (intelligent battery charger). Efficiently charge 12-24V batteries from solar panels, but can also be used with simple car battery chargers to prevent overcharging. Very high efficiency due to MOSFET switch and Shottky diode. 7.5A or 15A kit: **$26/$29** (K09)

BOSSMAN ELECTRONICS

A new subsidiary company to OATLEY ELECTRONICS, for giving TAX EXEMPT PRICES to entitled organisations. Product range will increase rapidly.

Phone (02) 9584 3562
Fax (02) 9584 1031

MASTHEAD AMPLIFIER KIT

Our famous MAR-6 based masthead amplifier. 2-section PCB (so power supply section can be indoors) and components kit (K03) **$15.** Suitable plugpack (PP2): **$6** Weatherproof box: (HB4) **$2.50.** Box for power supply: (HB1) **$2.50** Rabbit-ears antenna (RF2) **$7** (MAR-6 available separately)

PC POCKET SAMPLER KIT

Data logger/sampler, computer controlled chart recorder, slow speed scope. Incredible value value **$30**

WOOFER STOPPER Mk II

Works on dogs and most animals, PCB and all on-board components, transformer, electret mic & horn piezo tweeter ON SPECIAL: **$33**, extra tweeters (drives 4): **$7** ea Approved 13.8V 1A plugpack (PP6) **$10**

MORE KITS

- Geiger counter: **$40**
- Breath tester: **$40**
- 12V DC inverter for drivin compact fluoro lamps plus one CFL lamp: **$35**
- Music box: **$11**
- Ding dong doorbell: **$3.50**
- Siren using a 10cm speaker: **$14**
- Electric fence + used car coil: **$25**

LED BRAKELIGHT INDICATOR

60 1C LEDs plus two skinny 300mm long PCBs and a few resistors. Makes a very bright line of red light: **$18**

650nm LASER POINTER SPECIAL

Light weight 2 x AAA pen-size pointer with 650nm laser, very bright: **$55**

650nm LASER MODULE

Our new module has a 650nm laser diode. 35mm dia, very bright! **$50**

VISIBLE LASER DIODE MODULE KIT

NEW

Same circuit as our "visible laser diode kit" but a smaller PCB (25 x 50mm, WxD) that fits into tubing. 650nm/5mW laser diode, 3V: **$29**

CHARACTER DISPLAYS

Back in stock late this month! Standard 32 x 4 character displays using Hitachi ICs. **SPECIAL: $18**

DIGITAL BAR CODE WANDS

New, US made wands fitted with 2.5m curly cord terminated in a 5-pin 240º DIN plug. Has optical sensor, visible red LED, photo IC detector and precision aspheric optics. Converts bar codes into a digital pulse train as it's manually swept across the bar code. Uses a sapphire tip, pot size 0.19mm. Open collector TTL/CMOS compatible output, 5V supply: **$45**

NICAD CHARGER & DISCHARGER

Professional, SMD, switch mode, assembled and tested NICAD battery charger/discharger PCB assembly. For fast-charging 7.2V AA nicads. Basic info provided, plugpack not included. *Bargain:* **$9** ea or **3 for $21**

NICAD BATTERY SPECIAL

New 1.2V-400mAh cells wired in packs of 6. Each pack has a thermal cut out switch, each cell is 16 x 45 x 5mm, as used in mobile phones, 6 packs (30 batteries): **$10**

DC MOTOR SPEED CONTROL-EXPERIMENTERS PACK

20A motor speed controller kit (similar to SC - Jun 97) **$18,** plus two small new 12V DC motors (40mm dia, 40mm long) plus one used car windscreen wiper motor (has internal gear reduction): **$32**

3-Stage IMAGE INTENSIFIER TUBE

Back in stock. Make a high res night scope that works in starlight! Three tubes, the inverter kit and eyepiece. No housing or front lens: **$250**

COMPUTER POWER SUPPLY

New, complete PCB assembly only. Size 45 x 108 x 200mm. Switchable 120/230V AC input. DC outputs: +5V/6A, +12V/1A, -12V/1A, -5V/1A. Circuit provided, RU approval. Modern design. Mains input - not for the inexperienced! Be quick: **$16 ea** or **4 for $56**

12V/7Ah GEL BATTERY BARGAIN

Fresh stock 7Ah battery (150 x 95 x 65mm, 2.7kg) and one gel/lead-acid battery charger: **$30**

5mW/650nm LASER POINTER KIT

YES, NEW 650nm kit. Very bright! Complete laser pointer that works from 3–4V DC. Includes 650nm/5mW laser diode, new handheld case 125x39x25mm, adjustable collimator lens, PCB battery holder: (K35) **$30**

DISCO LASER LIGHT SHOW PACK

The above 5mW/650nm kit plus our AUTOMATIC LASER LIGHT SHOW: **$99**

PIR PCBS

Complete used 12V operated PIR PCB assys with relay, circuit and fresnel lens. Some may be faulty: **3 for $5**

HELIUM NEON LASER BARGAIN

Large 2-3mW He-Ne laser head plus a compact potted US made laser power supply. The head plugs into the supply, and two wires are connected to 240V mains. Needs 3-6V/5mA DC to enable. Bargain: **$100.** 5mW tube and 12V inverter kit: **$80**

OATLEY ELECTRONICS

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